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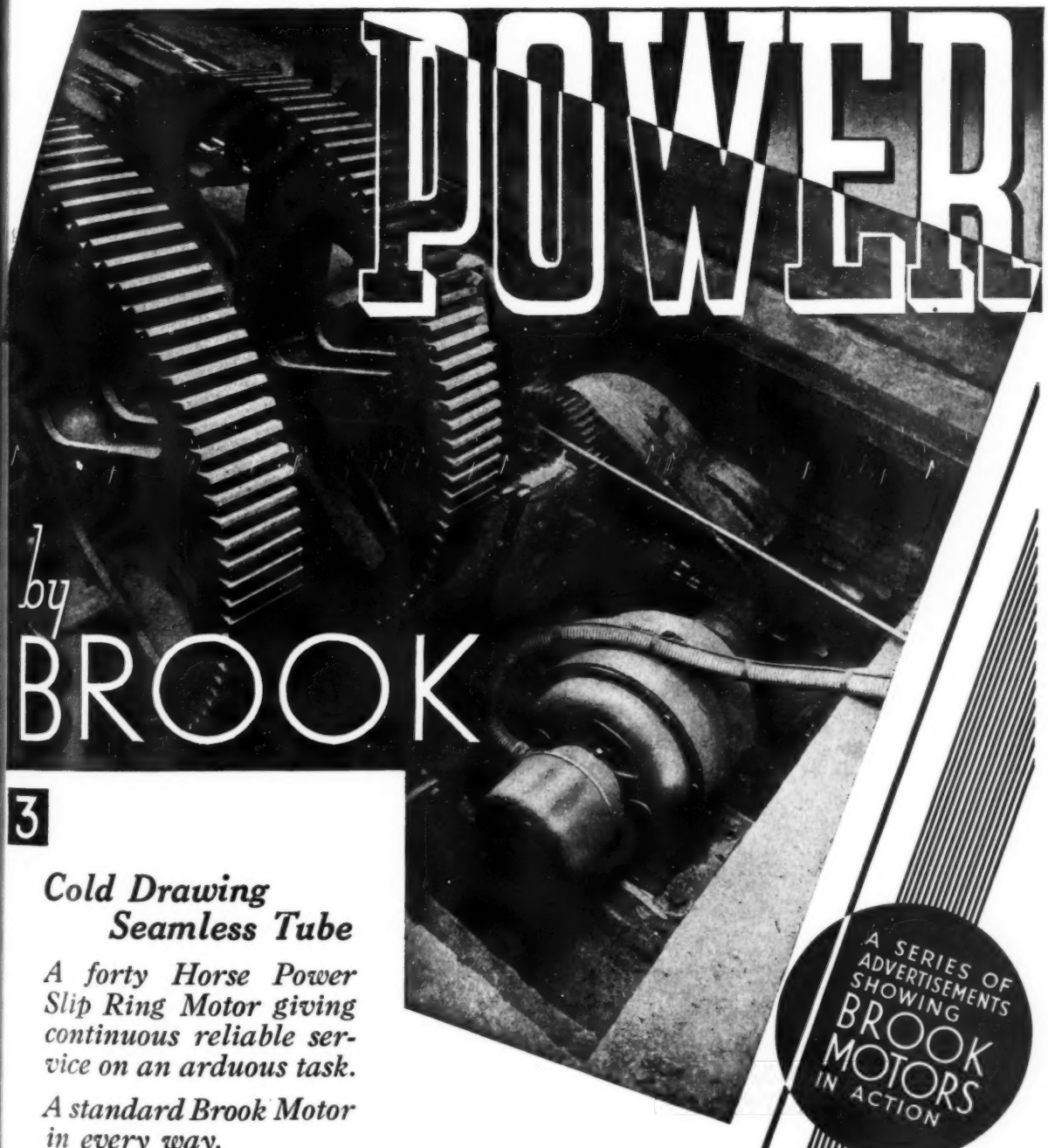

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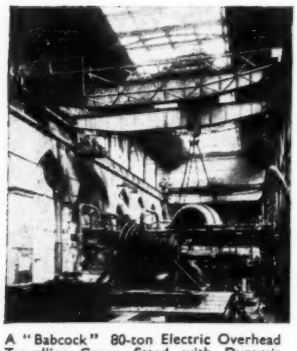

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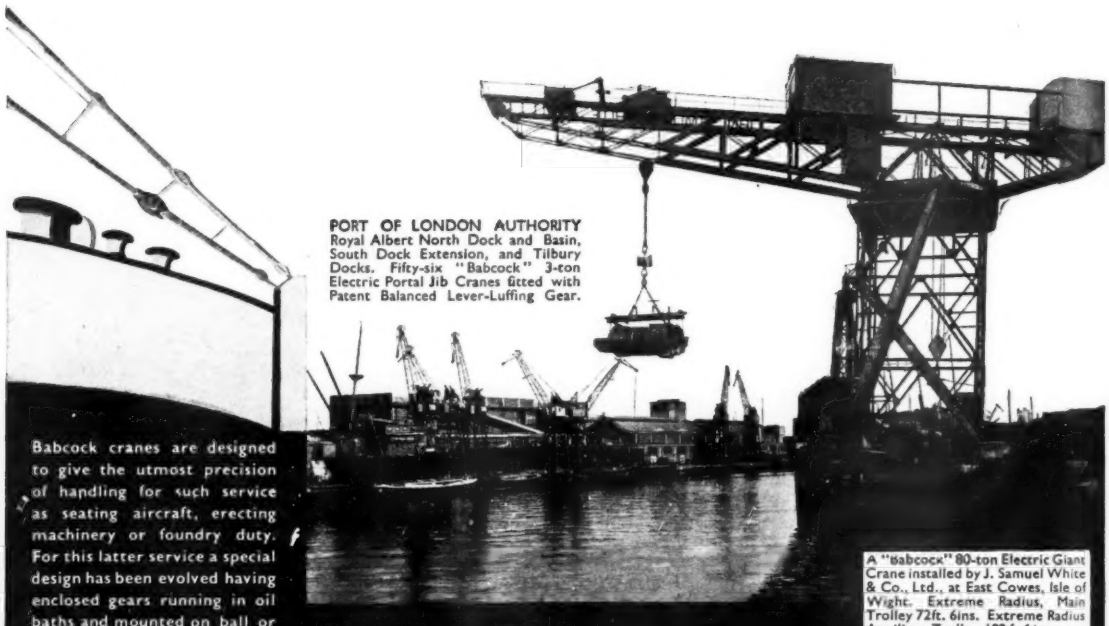

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The
Electrical Review

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Opportunities in Large Stores

A COMMON way of illustrating the magnitude of the load of a large consumer is to compare the kWh used with the output of a small, medium-sized or even big undertaking. The comparison goes further, as in both cases the problems of distribution have to be solved at the outset, and these are often more intricate for private installations than for public supply systems, since greater regard must be paid to a flexible lay-out in the former case with a view to providing for perhaps frequent alterations in internal structures later on.

A good example of such a comparison is provided by Mr. O. C. Waygood in his address, as chairman, to the Mersey and North Wales Centre of the I.E.E. In this he gives the annual consumption of Messrs. Lewis's five stores at about eleven million kWh (eight million in the largest), with a load-factor of 30 per cent., the bulk of which is all-day lighting and so of high power-factor.

Mr. Waygood deals with the engineering aspect as a whole; *i.e.*, he is concerned with the best means of securing the most economical results, irrespective of how they are obtained. It is all the more gratifying to find that he comes down so definitely on the side of electric cooking, which takes a fifth of the kWh supplied.

Not so satisfactory, from the electrical point of view, is his use of coal for raising steam for heating. However, his turning down of oil also on the score of expense, appears to indicate conditions under which the main consideration is the production of the greatest number of B.th.u. for a given sum, without taking much account of the space required and of the other drawbacks to alternatives to the electrical method that so often justify its being preferred on grounds of overall economy.

Such conditions are becoming more and more unusual in large cities, and room saved by installing an electrode boiler might be usefully employed in housing a larger emergency lighting battery. Where space can be afforded, scope may yet be found in large buildings for the heat pump employing the reversed cycle for cooling in summer.

How essential a part is played by electric power in running a modern store is well brought out by Mr. Waygood—refrigeration, ventilation, time, communications are but a few of the ways in which electricity is or could be used.

"Could be used" brings us to a point in Mr. H. Hobson's presidential address to the Association of Supervising Electrical Engineers on Tuesday. It is not sufficient, he implied, merely to substitute electricity for something else; much of the load of the future must be obtained by looking for new applications. A large store provides abundant scope for the imagination in devising additional outlets for electricity; thus, even "beauty treatment" can add 3 per cent. to the overall total consumption.

There are still important services not electrified, or incompletely so, that offer opportunities to electrical engineers with a knowledge of the practical issues involved. They can make of the large store with its diversity of trades a city in itself, in which new applications of electricity are brought right before the eyes of the public under working conditions.

More Speakers Wanted

ANOTHER public-speaking competition is being organised by E.D.A. for the 1935-36 season. The subjects chosen are: the advantages of the all-in rate; the influence of electricity on health; and how electricity helps the farmer—all very timely topics. We hope that there will be an increased eagerness amongst the junior members of the staffs of electricity undertakings to enter as competitors. A pamphlet has been issued, as in previous years, giving very full particulars, and intending candidates can obtain entry forms either from the E.D.A. officer in their area or from the head office at 2, Savoy Hill. We suggest that every "chief" should bring the subject to the notice of his assistants and give them fitting facilities and encouragement. Apart altogether

from the pleasure of winning a prize, there is the practical certainty that preparation for such a competition will raise the efficiency of the competitor and his or her value to the undertaking. We wish the movement a very successful winter, for the more ever-ready men and women there are at work spreading electrical teaching the greater will be the enthusiasm of the million-more movement. November 18th is the latest date for entry forms to be lodged, either with the entrant's chief engineer or manager or with the E.D.A. Area Officer in the district.

The Institution's Conversion

QUITE a number of members of the I.E.E., and among them many who are normally the most wide-awake, have confessed that the atmosphere of the lecture theatre at the Institution is as poppies and mandragora to them after a day's toil. These will not have to fend off sleep after the end of the present session, as the Council has made a good start this winter by deciding at last to bring the heating and ventilating systems up to date. An electrode boiler with thermal storage vessels is to be installed in place of the existing coal-fired boilers, and the temperature, thermostatically controlled, will bear a far closer relationship to the needs of the members than hitherto. No longer will papers on the warming of large buildings, such as that read by Messrs. R. Grierson and D. Betts last winter, be given under conditions that so effectively demonstrated the value of the authors' conclusions.

Hiring Schemes

THE electricity supply industry cannot afford to deny its consumers any facilities that the gas industry provides. That, if nothing else, is sufficient reason for the installation of hire, as distinct from hire-purchase, schemes. It is true that such schemes have their drawbacks. For instance, it is human nature for a hirer to care less than a "hire-purchaser" for an appliance. But fears on this score can easily be exaggerated. Of course a maintenance system is necessary, but that applies equally to apparatus under hire-purchase, although the maintenance has to be provided during the whole "life" of the appliance. Against this has to be set the greatly increased load and the improvement in load factor which a hire scheme brings, and, after all, load building is the reason for both hire and hire-purchase systems. In a letter published in this issue Mr. R. Illingworth, the borough electrical engineer of Poplar, shows the rapid response which his consumers have made to the hiring scheme commenced at the beginning of this year. He, at all events, does not fear that his stores will soon be choked with ruined and discarded cookers and wash-boilers—why should others?

The Technique of Utilisation

THE question of the precise ground that should be covered by a student in electrical engineering becomes more and more complex. He should, of course, have a knowledge of physics and mechanics as well as of electrical science, and it is recognised that too early a specialisation may make it difficult for him to adapt himself to change. Bearing in mind the ideal that training should be as broad-based as possible, allowance has to be made for limitations of time and of the powers of mental assimilation, and so, for practical reasons, a bias in one direction must be given at some stage of the training. It may profitably be asked whether a particular traditional study is really essential for the acquisition of an insight into a fundamental principle, or whether an alternative more nearly akin to the work of the future may not be equally suitable. We already have a division into heavy- and light-current sections but, as Mr. D. J. Bolton shows in his article this week, there is room for doubt as to whether this best meets the needs of the future. The utilisation field, with its possibilities of indefinite extension, would appear to present the kind of scope for the youth who possesses initiative and mental flexibility which was provided in earlier days by the production end.

Eyesight Preservation

CONSIDERING the close connection between adequate illumination and absence of eye-strain, it is curious how far short of the ideal is the lighting of many opticians' consulting rooms, even the cruder fault of glare being often in evidence. This is only the negative aspect, and Mr. W. J. Jones, of E.L.M.A., wants something more positive. In his address to the British Optical Association (International) Congress he urged the desirability of a closer working between the 3,000 opticians in this country and illuminating engineers in the interests of the nation's eyes. Much might be done, he suggests, by window displays demonstrating the simple scientific connection between lighting, seeing and eyesight preservation, while the new "study lamp" should find a place in every optician's equipment. Another suggestion is the preparation of printed cards pointing out such things as that full benefit from glasses is obtainable only when appropriate illumination is provided, and that three times as much candle-power is required to read a newspaper as a well-lighted book. The compound word "light-sight-conscious" that Mr. Jones uses may not be euphonious, but it tersely expresses the essential need.

Multum in Parvo

THE development of the new mercury-vapour lamp by the Philips research laboratories follows one of the main streams of progress in electrical engineering—reduction in size for given power. In return for an input of 1½ kW per inch the discharge column (less than $\frac{1}{16}$ in. thick) can give over a quarter-million candle-power per sq. in. In addition, a luminous efficiency of from 25 to 50 per cent. above previous mercury-vapour lamps and a considerable proportion of red in the spectrum are claimed (incidentally, it is at least questionable whether we need so much of the red band as the tungsten lamp gives us). The chief factor in producing these results is high internal pressure, the quartz tube of one lamp we have seen being subjected to more than half a ton per sq. in. The lamp is not yet in the production stage, and further developments are not improbable. Its main field of usefulness would appear to be in the projection of light as a concentrated beam.

Deferred Prizes

AT the opening meeting of the A.S.E.E. Mr. J. M. Reekie, the winner of the Highfield Shield, said that even if he had not been successful he would have regarded the knowledge gained in the preparation of his winning paper as more than justifying the effort. He is not alone in regarding an immediate tangible reward, acceptable as it may be on its own account, as only a small instalment of the prize that is to be found in ultimate success in one's life's work. In so far as the work involved helps towards that end, the less successful candidates are to be regarded equally as prize-winners. Therein lies the true value of such competitions, for which the entire industry, and not only the winners, is indebted to the donors of the incentives.

Over the Border

A NEW step in the tying in of the French transmission systems with those of Switzerland has been approved by a Decree authorising the Société des Houilleries de Ronchamps to construct a line connecting the transformer station at Essert, near Belfort, with the Swiss network now terminating at Réchésy. Copper conductors are to be used and the pressure will be 75 kV initially, provision being made for raising it to 150 kV later. The official view is, seemingly, that if a reliable supply can be obtained cheaply its source is immaterial.

The Institution of Electrical Engineers

The president and chairmen for the new session

[Elliott and Fry

Mr. H. Manley Roberts, Western Centre

Mr. F. C. Winfield, M.Eng., North-Eastern Centre

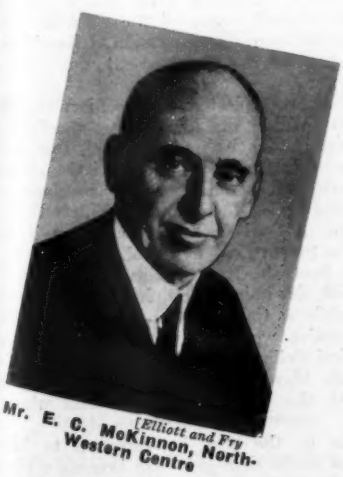
Mr. J. B. Mavor, Scottish Centre

[Lafayette

Mr. F. H. Clough, South Midland Centre

Mr. J. M. Kennedy (President)

Col. H. C. Fraser, North Midland Centre



[Elliott and Fry

Mr. E. C. McKinnon, North-Western Centre

Mr. W. Storey, Irish Centre

[Elliott and Fry

Mr. O. C. Waygood, Mersey and N. Wales Centre

Introducing the New Chairmen

THE first London meeting of the Institution of Electrical Engineers for the 1935-36 session will be held on Thursday next week, when Mr. J. M. Kennedy will deliver his presidential address. As is customary, however, the proceedings have already begun at a number of the local centres, the first being the Mersey and North Wales Centre, which met on Monday at the University, Liverpool, to hear the address of its chairman, Mr. O. C. Waygood, which is summarised on another page and is commented upon in our leading editorial.

On the same night the North-Eastern and Western Centres began their meetings at Cardiff; on Tuesday the North Midland Centre met at Leeds; and on Wednesday the South Midland Centre at Birmingham. Students' meetings have also been held in a number of places.

We present our readers on the preceding page with our group of portraits of the men upon whom has been conferred the honour and responsibility of presiding at the large number of events that are to take place between now and April next, and, as usual, we bring together a brief biography of each of the Centre chairmen as well as of the chairmen of the Wireless, Meter and Instrument, and Transmission Sections.

* * *

An account of the career of **Mr. J. M. Kennedy,** who, as everybody knows, is one of the Electricity Commissioners, prior to which appointment he was prominently identified with the profession as member of a well-known firm of consulting engineers, appeared in the ELECTRICAL REVIEW of June 7th, 1935.

* * *

Mr. E. C. McKinnon, the chairman of the North-Western Centre (Manchester), was born in Manchester of Scottish parents and was educated privately. Later he underwent a full-time electrical course at the Manchester College of Technology in April, 1893, joined the Chloride Electrical Storage Syndicate (an associated concern of Messrs. Mather & Platt, Ltd.) when they were just about to build an accumulator factory at Clifton Junction. During the next few years he gained a wide experience in the manufacture, design, installation and maintenance of storage batteries at home and abroad, and in 1904 he was appointed chief engineer to the Chloride Electrical Storage Co., which position he still holds. He has gained an international reputation for his many books, articles and lectures on storage batteries, and two papers read by him before the Institution of Electrical Engineers were awarded premiums. He has travelled extensively, and has resided for long periods in foreign countries.

Mr. W. Fennell (Transmission Section) (*Lafayette*); **Mr. O. Howarth (Meter and Instrument Section)** (*Kay, Manchester*); **Mr. R. A. Watson Watt (Wireless Section)** (*Lafayette*).

Mr. O. C. Waygood, Mersey and North Wales (Liverpool) Centre, was educated in Plymouth and Ireland, and received his technical education at the Salford Royal Technical Institute and at the Manchester College of Technology. He commenced his career in 1903 with Messrs. Mather & Platt, Ltd., and subsequently held engineering appointments with the Sunderland Forge & Engineering Co., Ltd., the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.

In 1919 he was appointed lecturer in Electrical Engineering at Liverpool University, and in 1931 joined Messrs. Lewis's, Ltd., as their chief engineer. He has been responsible for the engineering equipment of this company's new buildings in Leeds, Glasgow, Birmingham and Leicester. Mr. Waygood has been the honorary secretary of the Mersey and North Wales (Liverpool) Centre since for the six years since its inception in 1919.

Col. H. C. Fraser, chairman of the North Midland Centre (Leeds), received his early training in electric traction and power station work in Lancashire and Yorkshire, and has been on the staff of the Yorkshire Electric Power Co. since 1919. During the war he saw service with the King's Own Yorkshire Light Infantry, in France and Belgium, from 1915-18. He was wounded twice, mentioned in dispatches twice, and was awarded the D.S.O. In July last he was awarded the King's Jubilee Medal and the O.B.E. in recognition of his service with the Territorial Army, of which he is on the active list.

Mr. F. H. Clough, South Midland Centre (Birmingham), was born in Melbourne and educated at Geelong Grammar School. He was apprenticed to the Austral Otis Co., at Melbourne; the company was at that time chiefly engaged in manufacturing machinery for mining purposes. Here he gained experience both in the factory and in erecting machinery in out of the way places. On coming to England as a young man he entered Siemens Bros.' works at Woolwich. Subsequently he went to the Siemens & Halske Works in Charlottenburg.

A year and a half later he returned to England and joined the engineering staff of the British Thomson-Houston Co., whose works at Rugby had been recently built. After some time spent in general a.c. design he became associated with Mr. F. Samuelson in connection with the design of the steam turbo-alternator, being responsible for the electrical portion.

During the war, at the request of Mr. C. H. Merz, who was acting technical advisor to the Admiralty, Mr. Clough was made technical advisor to the Director of Torpedoes and Mines, for which work he was subsequently awarded the C.B.E. On his return to Rugby he was appointed assistant chief engineer, which position he still occupies. He was elected a member of the I.E.E. in 1913, and a member of the Institution of Civil Engineers in 1919.

Mr. F. C. Winfield, M.Eng., chairman, North-Eastern Centre (Newcastle-upon-Tyne), received his technical education at the University of Liverpool. He gained his early experience with British Thomson-Houston Co., at Rugby, and with the American General Electric Co., Schenectady and Pittsfield. In 1923 he joined the staff of Messrs. Merz & McLellan, with whom he is now chief electrical engineer. He has been associated with the design of the grid system and of the Barking and Dunston and other power stations at home and abroad, as well as several electric railways in the Dominions.

Mr. H. Manley Roberts, Western Centre (Cardiff), was trained with the Westinghouse Co. at Trafford Park, Manchester, and was subsequently employed on electric traction work for that company, including early L.C.C. tramway equipments and the original stages of the electrification of the Metropolitan Railway from the conversion of the old steam Inner Circle rolling stock to the present day electrical equipment.

He was afterwards responsible for many colliery electrification schemes in South Wales, and in 1913 was appointed colliery electrical engineer to the Ebbw Vale Steel, Iron & Coal Co., Ltd. In 1921 he was appointed chief electrical engineer of that company's works and collieries and its associated companies, John Lancaster & Co., Ltd., Powell's Tillery Coal Co., Ltd., Lancaster's Steam Coal Co., Ltd., and the Newport Abercarn Black Vein Steam Coal Co., Ltd.

Mr. J. B. Mavor, Scottish Centre (Glasgow), received his practical training with the Fairfield Shipbuilding & Engineering Co., Ltd., Drysdale & Co., Ltd., and at the Caledonian Railway Co.'s locomotive works, and his technical training at the Royal Technical College, Glasgow. He joined the contracts staff of Messrs. Mavor & Coulson in 1912, and during the war served with the Royal Engineers, with whom he attained field rank.

At the conclusion of the war he returned to Messrs. Mavor & Coulson as works manager. He became a director in 1920, and three years later he added to his duties the supervision of all the design work. He became managing director of the company in January last. Mr. Mavor is a

member of the Council of the Institution of Engineers and Shipbuilders in Scotland and of the North-West Engineering Trades Employers' Association.

Mr. W. Storey, Irish Centre (Dublin), was educated at St. Andrew's College, Dublin, and received his early training as pupil with Messrs. Egan & Tatlow, electrical engineers, Dublin. After completing his pupilage he became principal technical assistant with that firm and carried out important contracts in Dublin and in various parts of Ireland. He joined the staff of the G.S. & W. Railway, Ireland, in 1911 as electrical engineer, and was appointed electrical engineer to the amalgamated and absorbed Irish railway companies, known as the Great Southern Railways Co., in 1925. He is responsible for all electrical work in the chief mechanical engineer's department of the railway, including all electrical machinery and workshop equipment, train and bus lighting and electric traction. He has taken a prominent part in the activities of the Irish Centre of the I.E.E., and is also a member of the Institution of Civil Engineers, Ireland. Many important developments in the Irish transport system have taken place during Mr. Storey's service, with all of which he has been closely identified.

Mr. R. A. Watson Watt, chairman of the Wireless Section, graduated as B.Sc. (Eng.) at St. Andrews, with special distinction in electrical engineering. He became assistant to the Professor of Physics at the University College, Dundee, and later joined the staff of the Meteorological Office, on the invitation of Sir Napier Shaw, to investigate the application of radio methods to the location of thunderstorms. His next position was officer-in-charge of the branch of the Meteorological Office at the Royal Aircraft Establishment, South Farnborough, being seconded to the Department of Scientific and Industrial Research on the formation of the Radio Research Board. He has studied the wave-form of atmospherics in Europe, Asia and Africa, and in 1927 took over the scientific direction of the Research Station at Slough. On the unification of the station with the N.P.L. he became (in May, 1933) Superintendent of the Radio Department of the N.P.L. He devised the cathode-ray direction finder, and is joint author with two members of his staff of a monograph on the applications of the cathode-ray oscillograph in radio research. He is the author of many papers on radio problems, and has broadcast talks on "The Ordinary Listener and His Set," "The Weather House" and other subjects. He is chairman of the Council of the Institution of Professional Civil Servants, which includes practically all the electrical engineers, physicists and other scientific technical experts in the Civil Service, and is now treasurer, and was formerly vice-president, of the Royal Meteorological Society. He retires this year from the Board of the Institute of Physics.

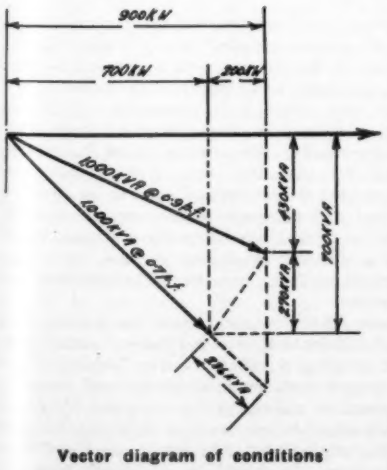
Mr. O. Howarth, chairman of the Meter and Instrument Section, received his technical education at the College of Technology, Manchester, obtaining a first-class pass in the City and Guilds honours grade examination in electrical engineering, and he received his practical training with the General Electric Co., Ltd., and Messrs. Ferranti, Ltd. In 1909 he joined the Manchester Corporation, with whom he later became chief assistant to the head of the Testing Department. He joined the Lancashire Electric Power Co. in 1919, becoming technical engineer and meter superintendent, which position he still holds. He is on the Committees of the North-Western Centre and the Meter and Instrument Sections of the I.E.E., the B.S.I. Committee on Instrument Transformers, the E.R.A. Committee on Pivots and Jewels, and the E.D.A. Committee on Domestic Water Heating, and has been a member of the E.P.E.A. since its inception, serving on various committees. He is now a member of the E.P.E.A. National Technical Group Committee. Mr. Howarth has read two papers before the I.E.E., and has written a number of articles for the ELECTRICAL REVIEW on his special subjects.

Mr. W. Fennell, chairman of the Transmission Section, received his technical education at Finsbury Technical College, and for a time was with the Galway Electric Co., and charge engineer with the House to House Co., West Brompton. From 1896 to 1900 he devoted part of his time to the development, in partnership with Mr. G. C. Allingham, of a patented twin lead covered wiring system. For several years he was chief assistant to a Westminster consulting engineer, and for a time was resident engineer with the B.I. Cables Contract Department. In 1906 he was appointed borough electrical engineer, Wednesbury, a position which he held until 1914, when he joined the North Metropolitan Electric Power Supply Co., being in charge of St. Albans and district for three years. He joined the Northwich Electric Supply Co. (now the Mid-Cheshire Electricity Supply Co., Ltd.) in 1918, when he took up his present position as general manager and engineer. He is a member of the Students' Committee of the I.E.E. and of the Council of the Diesel Engine Users' Association, and has represented the I.E.E. and the Diesel Engine Users on the Fuel Oil Committee of the Ministry of Munitions. He was a founder, past-president, and, later, hon. treasurer of the Overhead Lines Association. In the North-Western Area he is a member of the Central Electricity Board Consultative Committee, the I.E.E. Committee, the E.D.A. Area Committee and the Electric Vehicle Committee, and is also on the executives of the Whitley District Council and the Joint Board for the Electricity Supply Industry. Mr. Fennell is the author of a number of articles on rural electrical development, and contributed a series to the ELECTRICAL REVIEW a few years ago.

Power Factor Improvement. By T. H. Carr, A.M.I.E.E.

The economic limit

WITH the increased use of a.c., inefficiency in distribution due to low power factor has received much greater attention than formerly, and in many districts contracts with consumers contain clauses giving more favourable terms for the supply of power to plants operating at a high p.f. From a technical standpoint there is no reason why p.-f. connection should be uncertain or unsuccessful.



Vector diagram of conditions

It is easy in a self-contained works, where present requirements and possible future extensions are known, to install motors and plant which will provide a good p.f., whereas in an electricity supply undertaking many other considerations have to be taken into account. Actual conditions alone determine whether p.-f. improvement is commercially justifiable.

The question of what is the most economical final power factor is most important. When the p.f. is raised extra cost is incurred on phase-advancing plant, but there is a reduction in the cost of mains, or, alternatively, they are capable of transmitting a greater load. If the cost is estimated to rise it may be more economical to install phase-advancing plant than to lay additional mains.

The economic limit of power-factor correction is reached when the cost of phase-advancing plant, to produce a given increase in true power, is equal to the cost of generating plant to give the same increase in power.

If ρ is kVA of generating plant, $\cos \phi_1$ is initial power factor and $\cos \phi_2$ is final power factor, then the increase in true power will be $\rho (\cos \phi_2 - \cos \phi_1)$ and the kVA of phase-advancing plant necessary will be $\rho (\sin \phi_1 - \sin \phi_2)$.

Thus, if a system is working at its maximum kVA capacity with a lagging p.f. of 0.7, an increase of load could be met by (a) raising the p.f. of the system to 0.9 by the installation of phase-advancing plant, or (b) by installing additional generating plant, cables, &c., to meet the increased power demand.

Assuming that ρ=1,000, the increase in true power will be 1,000 (0.9−0.7)=200 kW, and the kVA of the phase-advancing plant required to be installed will be 1,000 (0.70−0.43)=270 kVA.

If the additional load of 200 kW is to be met by generating plant operating at 0.7 p.f., then the additional kVA required will be 200/0.7=286 (approx.). At an average of £10 per kVA, the total cost would be £2,860. When using 270 kVA of phase-advancing plant at a power factor of 0.9, the limiting cost, £x=286×10/270=£10.6 approx.

Heavy and Light Engineering. By D. J. Bolton

The sub-division of technical studies into production and utilisation

IT is the fate of all techniques to become increasingly complex and increasingly specialised. Engineering, which is the technique of science applied to the service of mankind, is no exception to the general rule; and in this respect it resembles life itself, in which the higher and more advanced the form the more specialised is its structure and functions. At one time an engineer was presumed to understand every sort of engine just as, at a still earlier period, a natural philosopher was supposed to comprehend all science. Your engineer was then indeed an all-round man and could take a hand in making or mending more or less anything that had wheels or metal to it. Then came the first main cleavage into three major groups—structural, mechanical and electrical—and for many years this sub-division was sufficient.

In recent years the youngest member of the trio has grown so fast that further sub-division has become imperative. Particularly has this been necessitated by the enormous development of high-frequency technology during the last ten or fifteen years. It was found that one man could not effectively be an expert on alternators as well as on lamps or valves, or on cables as well as on measuring instruments. Thus has arisen that rough division into the "heavy" and "light" current branches.

Left: The main Electrical Engineering Laboratory of the Regent Street Polytechnic. Right: The Advanced Electrical Measurements Laboratory

In technical colleges, and particularly in the full-time day courses, early specialisation is discouraged, and the aim is to give every student an all-round training in general engineering principles. But, owing to the vast diversity of the practising world into which they are so soon to be thrown, students in their later years have to be given some range of choice. A frequent plan in a three-year course is to make the first year common to all engineering students, to divide the second year up into the three groups of structural, mechanical and electrical, and to allow the third year (electrical) students certain alternatives in the way of heavy- and light-current subjects.

It is an easy matter to criticise this division into heavy and light, but it is much less easy to find any more satisfactory dividing line. It is true that it makes a cleavage between types of apparatus that are fundamentally the same, such as valves and rectifiers, or power cables and telephone cables. It is true also that any student trained only in the one section would immediately find himself needing information from the other. Many of these difficulties of demarcation are inherent in the problem itself. They are necessary reminders of the folly of undue specialisation and of the fact that all science is really one and that all techniques, even those which appear most diverse, interact to an astonishing extent. The student who rejects certain branches of knowledge as of no use to him in his line of business is likely enough himself to prove of no use to anyone in any line.

But specialisation and sub-division, although dangerous, are inevitable, and some of the difficulties just mentioned are not inherent but arise from drawing the dividing line in the wrong place. Particularly is there a failure to recognise the cleavage between the man who designs and makes the gear and the man who is called upon to use it.

Regarded from the manufacturing side, apparatus such as measuring instruments or relays would be classed as light-current engineering, whereas the principal users are on the heavy side. A division should then be made on functional grounds rather than on a rigid consideration of the type of apparatus employed. Thus a section dealing with the operating principles and use of measuring instruments may well be a central part of a general technological course, whereas a section dealing with the design and manufacture of such instruments should be offered only as an alternative and for those likely to be concerned with that line of business. The same thing might be said of machines, and in fact the claim of electrical-machine design to be an important fundamental subject has in recent years been strongly questioned. The answer to such a question depends not so much on what proportion of students are likely to have to design machines in later life (a very small and dwindling number), but on how far such a design course can be made fundamental and illustrative of general principles.

An Alternative Basis

There is another basis of division, somewhat different, although on parallel lines to the division into heavy and light. Generation and transmission are always on a very large scale, employing heavy machinery, whilst utilisation is spread over a large number of points consuming a small amount at each point. The whole process of electricity supply and utilisation can thus be regarded as a long chain of events, starting with fuel and finishing with electrically produced power, heat, light and sound. This long chain can then be cut up into suitable lengths, according to the number of divisions required. Such a basis is slightly less arbitrary and lends itself to greater sub-division than does the simple allocation into "heavy" and "light," and it takes account of the difference in viewpoint between the makers of the apparatus or energy and the users.

In the institution with which I am connected (the Regent Street Polytechnic) a division on these lines has been made with very satisfactory results. The early years of the evening work are of a general character, but in the later years alternatives are provided to correspond, as far as possible, with the employment and prospects of the various students. This more advanced work is divided into three groups, which may be called the power and machinery section, the utilisation and measurement section, and the high-frequency and communications section.

The first comprises electricity generation, transmission and the technical side of distribution, machine design, control gear, and, in fact, most of what is called "heavy" electrical engineering. The second includes instruments and measurements and all aspects of utilisation for purposes of power, light and heat (including electric traction and illumination). The third covers the whole field of high-frequency and fractional-current technology. It should be explained, however, that this division is made primarily for purposes of staffing and supervision, and to ensure that each important branch is covered without gaps or overlapping. The students themselves are not necessarily confined to the subjects in any one section.

Such a division would probably be criticised by traditional educationists for making too much of what may be called the utilisation side and too little of the solid backbone of the industry—heavy machinery and supply. But an analysis of occupations, particularly in the London area, would certainly not uphold any such objection. Even in electricity supply about 70 per cent. of the staff is on the distribution side, and a considerable number of these are taken up with matters concerning the sale and use of their product rather than with the purely technical problems of its distribution. In manufacture, as design of the earlier and more stabilised products becomes thoroughly standardised, there is a continual drift of the staff towards the newer and lighter developments. In fact, so many of the problems on the supply and heavy-machinery side have been either solved or delegated to relatively small groups, such as the Central Board, that only a very limited number of trainees can be absorbed.

Utilisation of electricity, on the other hand, changes continually, and fresh avenues are opened to it every day. The successive waves of invention which gave us the radio and the "talkies" are obliterated only by fresh waves as electricity is used as a measuring agent, in healing, for traffic control, for agriculture, and the rest. Meanwhile the tide continues to advance and shows no sign of ebbing. All these new uses not only require the services of technicians to invent and manufacture the apparatus, but they also create new problems in installation and in the distribution and sale of the energy.

Utilisation Efficiency

There is another reason for an increasing employment on the utilisation side besides its enormous variety, and that is its comparative inefficiency. One may hazard the generalisation that the farther one travels from generation to utilisation the farther do the efficiencies obtained lag behind those theoretically obtainable. Whilst not suggesting that power stations have reached perfection, it will be generally agreed that there is a much greater distance to be travelled in the efficient use of electricity than in its efficient generation. This distance will have to be travelled by the young men now going through our training colleges, and any reorientation of classes that better fits them for the job is to be welcomed.

The grouping mentioned above as having been adopted at the Regent Street Polytechnic is an attempt in this direction. It was felt that we engineering teachers often fail to recognise the changing position of the centre of gravity of the industry. As a result far too much time is spent in solving problems that no longer arise and too little in preparing students to design the new apparatus and develop the technique for the new fields of utilisation opening up before them. It is true that the former type of problem conveniently lends itself to laboratory and mathematical solution, whilst the latter often eludes our grasp. We can study the behaviour of a motor on a varying load, whilst we cannot so easily study the behaviour of a consumer on a varying tariff. The torque of the one is a predictable quantity, but the talk of the other is unpredictable and often unprintable!

Let it not be thought, however, that there is any suggestion of scrapping our existing methods and equipment in favour of classes on future inventions or the psychology of the consumer. Our present rotating and heavy-current plant is likely to remain the backbone of the work, both on account of its practical uses and for the educative value of its working principles. But we must for ever beware of being blinded by tradition, of thinking that some especial virtue attaches to certain historic pieces of apparatus, or of feeling that it is a little undignified to dabble in these newer problems of utilisation.

At risk of serious heresy I would essay the opinion that such aspects of electricity supply as load diversity are just as important practically as, say, the armature windings of a d.c. motor, no less fundamental or educative, and just as useful a basis for the exercise of mathematics, graphs and diagrams. Yet no ordinary technical student would be turned out with a knowledge of the one or without a knowledge of the other.

In conclusion, I do not suggest that the above line of demarcation and change of emphasis will solve all our difficulties. Engineering is really one subject; and attempts to divide it up—however convenient and however essential—are all more or less unfortunate. This granted, it may be maintained that a division between production and utilisation is a better line than that between heavy and light. Such a division is based on a logical distinction of function rather than mere size, and may well be used to pave the way to a more extensive treatment of the utilisation end.

A Super-pressure Mercury-vapour Lamp

WE have had an opportunity of witnessing a demonstration of the new "Philora" discharge lamp that was exhibited at the opening meeting of the Illuminating Engineering Society last week. This lamp, which is the result of experiments carried out by Mr. Bol in the physics laboratories of Philips Lamp Works, consists of a quartz tube having an internal diameter of about 5/64 in. and an external diameter of ¼ in., its length being proportional to the luminous flux and intensity.

At each end is a tungsten-wire electrode sealed into the quartz with an interposed layer of a special grade of glass, without which a hermetic seal would not be obtained due to the difference between the coefficients of thermal expansion of tungsten and quartz. The electrode tips are coated with alkaline earth oxides to facilitate the emission of electrons; they just project from drops of mercury which condense at each end. The inner tube (in which the temperature is from 4,000 to 8,000 deg. C.) is in a jacket containing running water.

The lamp normally functions with a.c. and steady operation is achieved by feeding the lamp through an auto-transformer, the no-load voltage of which is enough to "strike" the lamp.

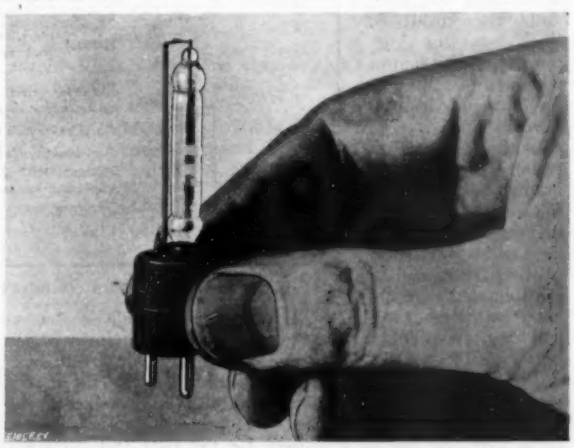
Rating is defined by the potential gradient between the electrodes, which has so far been restricted to 1,250 V per in. by the corresponding internal pressure, under which conditions the lamp takes about 1,500 W per in. of discharge with 1.35 A. The power factor of the lamp alone is about 0.9.

The spectrum is continuous; although the mercury lines stand out they are greatly broadened. Colour distortion is therefore slight. Variations in the rating of the discharge modify the spectrum. Thus the 2,537 A.u. line in the ultra-violet band is an emission line at slight pressures and becomes an absorption line at the higher gradients, its breadth then rapidly increasing towards the long waves.

At 8 in. from a 500-W lamp the energy received per sq. in. between 0.5 and 0.6 μ (the middle of the visible spectrum) is equal to that of direct sunlight; between 0.3 and 0.4 μ (ultra-violet) it is five times as much, but from 0.6 to 1.0 μ (infra red) it is only half.

The internal pressure was ascertained by measuring the breadth of the absorption load at 2,537 A.u. It was found that $p=2$ (G−250), p being the internal pressure in lb. per sq. in. and G the potential gradient in V per in.

A luminous efficiency of from 50 to 60 lumens per watt is claimed. The light source being less than 3/64 in., the brightness may be as much as 260,000 candle-power per sq. in. (or about one-quarter that of the sun) compared with 110,000 for the carbon arc. This feature suggests an application where light is required as a concentrated beam. The small dimension permits the use of smaller optical devices for projection.



This picture gives an idea of the small size of the new lamp

As the lamp is extinguished twice in each a.c. cycle, revolving shutters on cinema projectors are unnecessary and screen illumination is thereby doubled. The movement of the film and the extinctions are synchronised to ensure a change of picture during the dark period.

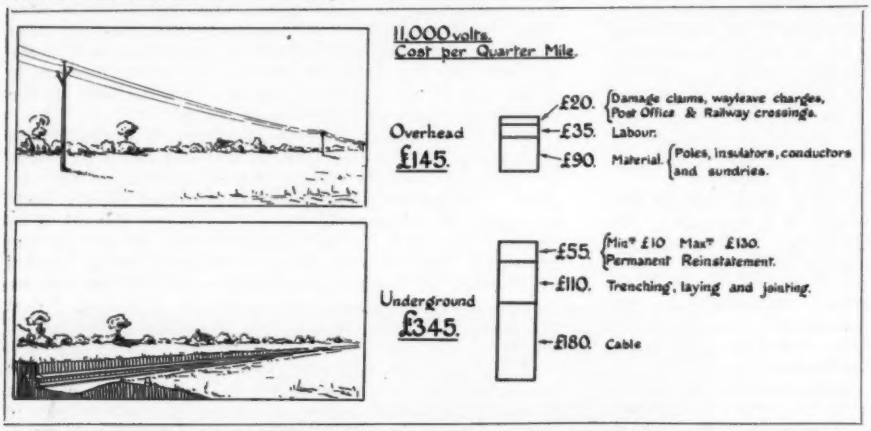
We also took the opportunity to examine another new super-pressure mercury-vapour lamp of lower rating which functions in air. This type is less rich in red rays, but correction can be obtained by using a reflector treated with "Signalon"—a fluorescent red paint. A luminous efficiency of 40 lumens per W is claimed for the air-cooled lamp, which requires 70 W for its operation and has a discharge length of ½ in. It is intended mainly for general illumination.

Serving Rural Areas

By E. P. Burdett, M.A., A.M.I.E.E.

The costs of underground cables and overhead lines compared

THE layman often finds it difficult to appreciate the desire of the electricity supply authority to erect overhead lines in preference to underground cables. He can see that the overhead line is visibly a well-made and costly structure, and assumes that the unseen underground cable cannot be much more expensive, as it requires neither poles nor insulators, but only a narrow trench.



One of the comparative diagrams used to show the extra cost of laying mains underground

Diagrams on the lines of those reproduced have been found very useful in explaining to a landowner or local councillor why an underground cable costs so much more as to be often prohibitive. The costs are typical and vary considerably between one job and another, according to length, time of year and difficulties encountered, but they represent a fair comparison between overhead and underground construction.

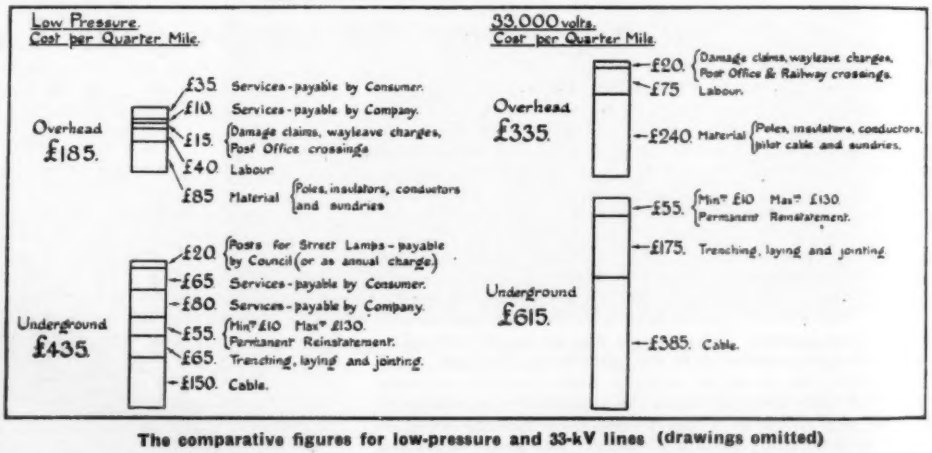
All lines and cables illustrated are supposed to be 0.1 sq. in. copper equivalent in section and ¼ mile in length, and the prices of copper, lead and aluminium are those ruling in the summer of 1935. Allowance has been made for the capitalised cost of wayleave rentals and for an average number of telephone and railway crossings. To ensure fairness, short lines and frequent angles have been assumed, and the overhead line costs are high compared with figures commonly obtained for long and straightforward runs.

In the case of high-voltage mains the diagrams indicate that the complete overhead line costs less than the bare cable, exclusive of trenching, laying, jointing and permanent reinstatement. The use of underground cable in the examples given would increase the cost of a 33-kV main by 80 per cent. and of an 11-kV main by 140 per cent., or much more if the trenching and reinstatement were difficult. The smaller margin in favour of the 33-kV overhead line is due to the provision of a catenary wire which serves as a continuous earth wire and also as a support for the pilot and telephone cable. On rural 11-kV lines a pilot cable is unnecessary, and the metalwork is separately earthed at each pole.

These savings are convincing enough, but it has to be added that overhead construction permits an important economy in sub-station costs for rural supplies. A small transformer can be mounted on the terminal pole of an 11-kV overhead line and controlled on the high-voltage side by pole-mounted switch-fuses, with a simple cabinet for low-voltage fuses and metering at a total cost of about £100. A sub-station fed by underground cable usually calls for the purchase of a plot of land, fencing and expensive switchgear at three times the cost.

The diagrams of the low-voltage construction show, in addition to the direct capital costs, the effect on service charges and street-lighting charges. The overhead line gives a marked saving in service charges both to the supply authority and to the consumer, owing to the simplicity and cheapness of overhead services. Public lamps can be erected on the overhead line poles and the local council is saved the cost of separate posts.

The extra cost of low-voltage underground cable is shown to be 135 per cent., taking all these factors into account. Underground cable is, however, more frequently justified for low-voltage distribution than for high-voltage work, as circumstances sometimes combine to reduce the advantage of the overhead line. Underground cable must be considered for sections where the village street has irregular frontages, no footpaths, frequent bends, and numerous telephone wires, and also where high- and low-voltage lines have to be taken along the same route.


Low Pressure.
Cost per Quarter Mile.
Overhead
£185.
£35 Services - payable by Consumer.
£10 Services - payable by Company.
£15 Damage claims, wayleave charges, Post Office crossings
£40 Labour
£85 Material Poles, insulators, conductors and sundries
Underground
£435.
£20 Posts for Street Lamps - payable by Council (or an annual charge)
£65 Services - payable by Consumer.
£80 Services - payable by Company.
£55 Min.m £10 Max.m £130. Permanent Reinstatement.
£65 Trenching, laying and jointing.
£150 Cable.
33,000 volts.
Cost per Quarter Mile.
Overhead
£335.
£20. Damage claims, wayleave charges, Post Office & Railway crossings.
£75 Labour.
£240. Material Poles, insulators, conductors, pilot cable and sundries.
Underground
£615.
£55. Min.m £10 Max.m £130 Permanent Reinstatement.
£175. Trenching, laying and jointing
£385. Cable.

The comparative figures for low-pressure and 33-kV lines (drawings omitted)

It is common practice to lay underground cable in fully built-up areas, because the much higher revenue per mile permits the supply authority to carry a higher cost of distribution. In the smaller country villages and the scattered outskirts of small towns there is usually no alternative to overhead construction, as high distribution costs would make the extension far too expensive.

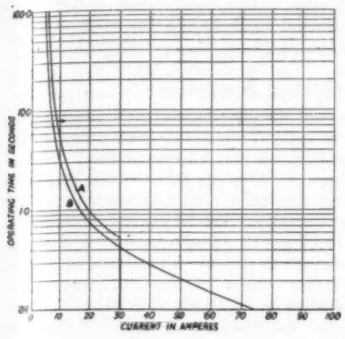
An Electrically Operated Floating Dock

A FLOATING dock capable of raising vessels weighing up to 8,500 tons, which has recently been put in service at Bergen, Norway, is interesting on account of its equipment. The dock is approximately 600 ft. in length and 100 ft. in width. The necessary power is tapped from the municipal mains in the form of a three-phase 220-V 50-cycle supply, and is led into the dock through six cables each of 150 sq. mm. section, suspended so as to allow movement. The distribution equipment is situated in the lower storey of the switchgear house. The most important machines for service are two pumping sets to empty the dock when it has to be raised. The two pumps are lodged in the lower part of the dock and driven by vertical shaft motors developing 60 kW at 600 r.p.m. and capable of a 25 per cent. overload for two hours. A small scavenging and fire-extinguishing pump is mounted beside the main pumps, this being driven by a 25-kW motor running at 1,000 r.p.m. and it is equipped similarly to the main motors. Included in the dock equipment is a travelling crane operated by standard spray-waterproof motors. There is also a convertor set in the lower storey of the switchgear house, composed of a 70-kW, 1,500-r.p.m. three-phase motor, coupled to two 32-kW, 110-V d.c. dynamos for supplying current to the ship lying in the dock and also to the four warping winches of the dock used to draw the ship into it. The interior of the dock is divided by watertight partitions into twenty chambers, each of which can be connected up to the pumps by pipes and valves or to the surrounding water. Each chamber is opened or closed by a valve remote-controlled from a desk panel in the switchgear house. The electrical equipment was supplied by the Norsk Elektrisk A/S and the Brown Boveri Co.

Time-limit Fuses. By H. Hurworth

Characteristics required to ensure satisfactory service

TIME-LIMIT fuses are probably the most common means of obtaining graded time discrimination. The apparent simplicity of the method is liable to lead to careless use, and in order to avoid encroachments on the stability, which will not be apparent until revealed by the passage of a fault current, it is necessary to co-ordinate the characteristics of both the fuse and the coil or relay very carefully indeed.



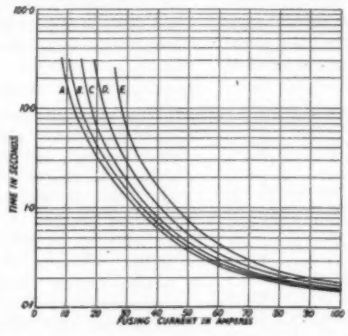


Fig. 1.—(A) Effect of low relay impedance on the time characteristic, and (B) a stable curve obtained by adding impedance in series with the relay. Fig. 2.—Alteration in fusing time characteristics caused by varying the fuse length from 5 in. (A) to 3 in. (B), 2 in. (C), 1 in. (D), and 0.5 in. (E)

The fundamental principle, which applies equally to trip coils operating directly on to the switch toggle mechanism or to remote relays operating a d.c. shunt trip coil, consists of shunting the coil by a fuse to impart to the combination the inverse-time characteristics of the fuse itself. To achieve this result it is essential for the fuse to blow before sufficient current passes through the relay to cause tripping, and requires the relay to possess an impedance of a high value compared with that of the fuse. The actual ratio will be dependent upon the maximum value of the fault current for which the relay is required to be stable, and also the limitations on this value which may be imposed by a high secondary burden restricting the current transformer output, due to saturation of the core.

Relay Impedance and Stabilisation

For general purposes a ratio of twenty to one, used with a 5-A relay setting, will provide satisfactory operation up to a current value at which the fuse will blow almost instantly and thus have no appreciable effect on the time of operation.

The effect of a low relay impedance on the time characteristic is shown in curve A, fig. 1. This curve is unstable, collapsing at 30 A, and currents exceeding this value will operate the relay instantly, in some cases without blowing the fuse. Curve B shows the stabilising effect of adding a resistance in series with the relay. The time delay is slightly smaller, due to less current passing through the relay coil, although the slope of the curve remains even with time values of less than 0.1 sec.

As a method of obtaining discriminative operation of switchgear the scope of time-limit fuses is limited by the shape of the fusing time characteristic curve, and consequently this is of the utmost importance.

The curve should be designed to reproduce the characteristics of the induction-wattmeter relay as far as possible, since this relay is the most reliable method of obtaining graded time discrimination. Consideration of the characteristics of these relays shows that the limitations of time-limit fuses for discriminative operation will be governed by the minimum fusing current; time lag with large fusing currents; and consistent reproduction of the standard characteristic curve.

The value of the minimum fusing current must be reasonably low for general purposes, although small fuses should not be used indiscriminately.

Where separate earth-leakage protection is not provided, a low minimum fusing current is necessary in order to ensure isolation of the apparatus under earth-fault conditions, particularly where the current transformer ratios are high, or the fault current is limited by high earth resistance. But where it is possible to include earth-leakage protection without upsetting the grading of the system, the strongest argument in favour of small time-limit fuses is removed, and it is a serious mistake to provide them at the expense of a possible encroachment on the stability.

Although small time-limit fuses are sometimes used for protection against overloads the practice is to be deprecated, as they are totally unsuitable for this purpose on systems having any pretensions to discrimination owing to the danger of inadvertent operation caused by running at temperatures approaching melting point.

It is clear that point must be taken into consideration when choosing the fuse metal in all cases where small fuses are required, as rapid oxidisation at high temperature will seriously alter the characteristic curve, thereby upsetting the stability of the protection, although it may not cause operation under normal load conditions.

The usefulness of time-limit fuses for the discriminative grading of systems is chiefly limited by the small time lag which they provide under heavy fault conditions and, therefore, this value must be as large as possible. Two methods of improvement are available, namely, by choosing the most suitable metal for the purpose, and by increasing the length of the wire.

The range of metals is narrowed to those which possess the following characteristics. No difficulty must be found in obtaining consistent performance from new samples. This rules out metals such as an amalgam of lead and tin, which cannot be guaranteed to provide consistent results if purchased from alternative sources. The mechanical strength must be reasonably great to prevent damage when wiring. Resistance to oxidisation must be considerable, in order to prevent rapid deterioration and consequent alterations to fusing characteristics.

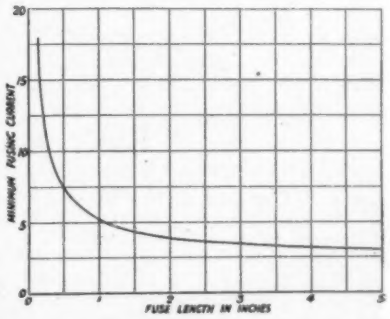
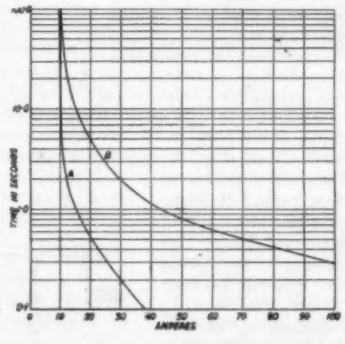


Fig. 3.—Relation between the minimum fusing current and length of fuse (No. 27 s.w.g. tin wire)

By experimenting with various suitable metals, it has been proved that if the cross sectional area required for a given minimum fusing current is greater, the fusing time under heavy current conditions will be longer. As a result of these tests pure tin was found to provide fairly long time lags, and on this account was adopted as the most suitable metal for the purpose.



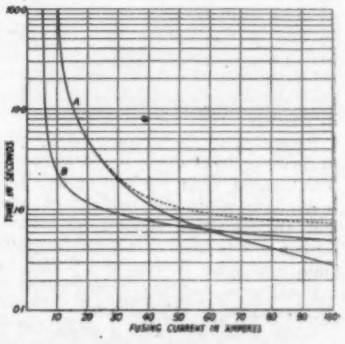


Fig. 4.—Characteristic curves of time-limit fuses consisting of (A) No. 27 s.w.g. tin wire 0.3 in. long and (B) No. 20 s.w.g. tin wire 2.5 in. long, each with a minimum fusing current of approximately 10 A. Fig. 5.—Characteristic curves of (A) time-limit fuse, and (B) induction relay with a definite minimum setting. The dotted curve shows (A) modified by secondary impedance

The length of a fuse has a considerable bearing on its time characteristic curve. This is illustrated by fig. 2, which shows how the curve is altered by length variations, and fig. 3, which shows how the minimum fusing current varies with

the length. These curves demonstrate that the fusing time at large current values is not seriously affected by altering the length, although considerable alteration will be caused to the minimum fusing current. Consequently, by lengthening the fuse, a larger wire may be used without increasing the value of the minimum fusing current, although the fusing time at large current values will be greater. In other words, an increase in both the length and diameter of the wire simultaneously results in a fuse which possesses the same minimum fusing current, but has a greater time lag with large fusing currents.

The extent to which the characteristic curve can be modified in this way is clearly illustrated in fig. 4, which compares the curves of two fuses, both of which have the same minimum fusing current but possess entirely different characteristics under heavy current conditions.

Fig. 5 enables a comparison to be obtained between the characteristic curve of a fuse constructed on these lines, and that of an induction relay; although the fuse curve is not so good as that of the relay it will provide reliable discrimination up to ten times the minimum fusing current—a value large enough for most distribution requirements.

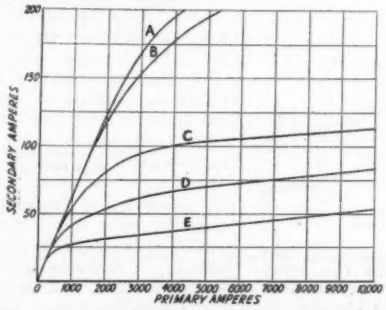


Fig. 6.—Ratio between the primary and secondary current of an 80/5-A wound primary current-transformer with secondary impedances of (A) 0.05 ohm, (B) 0.1 ohm; (C) 0.5 ohm, (D) 1.0 ohm, and (E) 2.0 ohm

Where circumstances demand special treatment it is possible almost to reproduce the definite minimum features of the induction relay by inserting a suitable impedance in series with the current-transformer secondary circuits. This produces early saturation of the current-transformer core, and consequently causes a reduction in the secondary current flowing through the time-limit fuse.

The dotted line in fig. 5 shows the extent of this modification when applied to the characteristics of the time-limit fuse in curve A, and indicates that the new curve possesses definite minimum characteristics, equal to those of the induction relay (curve B).

To modify the curve in this manner requires transformer characteristic curves similar to fig. 6, which shows the ratio between primary and secondary current with different values of secondary impedance, and as this information is sometimes difficult to obtain the method is of most value as a means of improving existing equipment which has proved unstable.

Consistency Necessary

The characteristic curves of all fuses of the same rating must be exactly alike, in order to prevent inadvertent operation through encroachments on the clearance time between successive relays. To ensure this, all fuses must be of the same length, and certain limitations on this are imposed by existing designs of fuse carriers. The majority of these can be adapted to give a fuse length of two to two and a half inches, which is long enough to provide a satisfactory characteristic curve. Any carrier which cannot be converted to provide a fuse length within these limits should be changed, otherwise the tolerance will be too great for accurate discrimination.

Great care is necessary in wiring the fuse, or the delicate strand will be damaged or cut by clamping screws. The best method is to solder the wire directly to the terminal block or to a suitable metal washer, which can be clamped or screwed into good contact with the block itself; the actual connection must have as low a resistance as possible in order to maintain the high impedance ratio between the fuse and relay.

Before putting fuses into service they should be subjected to a current of approximately 60 per cent. of the minimum fusing current for a period of half a minute, so as to ensure that the wire has not been damaged by soldering.

Electrostatic Recording and Reproduction

"ELECTROGRAPHY" is the name given to a new method of inscribing oscillograms, pictures, drawings, or the like on the surface of a plate or cylinder of insulating material by means of a variable electrostatic point-charge, which is made visible by dusting the surface with powder. If desired, the record can be "fixed." The speed and fidelity of reproduction are such as to make the method applicable to picture telegraphy, sound recording and recording of transients.

The method and its applications form the subject of a communication by P. Selényi from the Tungsram Research Laboratory, Budapest-Ujpest, to the Hungarian Electrotechnical Association. The author showed, at the Physical Congress, Hamburg, in 1928, that the track of a cathode ray oscillograph spot could be marked by dusting the outside of the bulb with red lead, and the same principle has now been extended to the recording of a variable electrostatic charge on an independent insulating plate in free air.

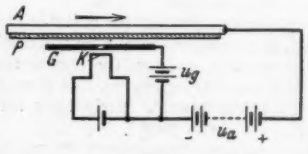


Fig. 1

Referring to the accompanying illustrations, from *Elektrotechnische Zeitschrift*, fig. 1 shows a hot cathode K, of platinum coated with barium oxide; a metal screen G which is pierced to allow the passage of a very fine pencil of ions; and an insulating sheet P mounted on an electrode A. The screen G acts also as a grid controlling the ionic flow. The plate P may be of ebonite ½-½ mm. in thickness. The screen G is set some tenths of a millimetre from K; and P is as close as possible to G, say ½-1 mm.

With K heated, and a sustained plate voltage μ_a of 500-1,000 V, a "spot" 5 or 6 mm. in diameter is ultimately formed on P and can be rendered visible by dusting with lycopodium powder. If, however, A is displaced in its own plane the electrostatic record is a sharp line which is narrower the faster the movement of A and the more negative the bias of the grid G. The surface charge remains without appreciable spreading or leakage for 5 to 10 min. on clean ebonite, so that an accurate record can be "developed" by dusting within 5 or 10 min. of the "exposure."

The minimum thickness of the powder lines depends on the fineness of the powder. Lines down to 0.03 or 0.04 mm. in width can be produced with lycopodium. Good reproduction of a portrait is obtained with a 0.75 mm. (0.03 in.) square hole in G, a plate voltage of 1,200 V, and a grid voltage variable between +2 and −4 V.

An experimental transmitter and recorder for picture telegraphy is shown in fig. 2. The film to be reproduced is mounted on a glass cylinder *2* containing a cæsium photo-cell *3* illuminated by the optical combination *6*, *5*. The p.d. across the high resistance *7* (about 5 megohms) is applied to the grid of the electrographic recorder, subject to the grid bias *8*, and about 1,000 V is maintained between the recorder cylinder *1* and the hot cathode. The ebonite surface of the recorder can be used repeatedly for temporary records, or paper coated with paraffin, shellac, dammar varnish, or the like can be used, the powder then being "fixed" by warming.

A 3½×4¼-in. section of a map full of detail was reproduced completely in 20 sec., using a drum speed of 900 r.p.m. and a feed of 0.3 mm. (about 0.012 in.) per revolution. For the recording of speech or oscillograms a slot grid is used, with the length of the slot perpendicular to the displacement of the recorder plate. The microphone current is transformed to a pressure of a few volts for application to the grid; no amplification is necessary. A morse key, with the back contact connected to a suitable negative bias, prevents the recorder from acting until desired.

Alternatively, by the permanent application of a suitable

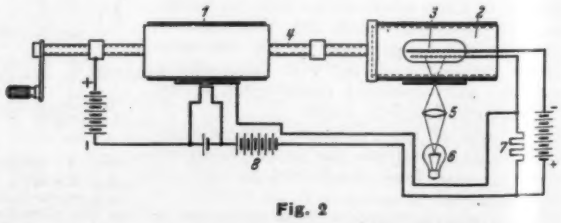


Fig. 2

negative bias, the recorder can be made to register surges of any predetermined intensity automatically. The author claims that up to several hundred thousand points per second can be recorded by this method, in which case it may be applicable to the televising of moving pictures, or television by the intermediate film process.

Electricity in Departmental Stores

Many uses and a substantial load

FOR his address as chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers at Liverpool on Oct. 14th, Mr. O. C. Waygood chose to speak of the engineering equipment required in a modern departmental store, drawing special attention to the varied nature of the electrical load.

The author says that the tendency of these stores is to purchase at high voltage and transform, which necessitates the provision of a sub-station. The type of main switchboard that lends itself best is the totally-enclosed ironclad pattern, having oil circuit-breakers with draw-out and isolating features and the usual protective devices, with sectionalisation controlled by bus-couplers.

A typical installation described consists of a board 63 ft. long with fifty-three l.v. circuit-breaker units. The incoming supply is passed through three 600-kVA transformers with 900-A oil switches, while 300- and 400-A switches control the heating, lighting, and power sections.

For distribution main cables of the "drained" paper or fibre insulated types adapt themselves well to buildings of this nature. Apart from the main services, auxiliary three-phase and neutral cables running through from the basement to the top floor are useful for dealing with demands of from 10 to 100 A, with a tapping point on each floor for sundry power. The most convenient form of sub-circuit control is a combined switch and fuse board, which may be quite large and needs a main isolating switch and double-pole circuit switches each fed through a pair of fuses.

Plugs should be provided on a liberal basis, both as to quantity and size, for loads varying up to 10 A. Six to eight plugs fed by a pair of 7/.036 v.i.r. cables, each with its local control, may be taken as a guide. Flexible cables should be used as sparingly as possible.

Light to the store is equivalent to power in industry. It is used during normal daylight hours at the same time as manufacturers use motor power. Yet there are still some supply authorities who, when discussing tariffs, attempt to differentiate between energy used for lighting in a store and that used for power in factories.

In Mr. Waygood's opinion the ideal form of lighting has not yet been found. It should be of varying quality and quantity to suit all classes of merchandise. This problem needs diligent attention. It is essential to provide an independent source of lighting for use in emergency. A battery system has many advantages, and the importance of immediate change-over at the critical moment cannot be overemphasised. A battery of 100-kW capacity is the approximate size required for a store having eight floors and a sub-basement.

Staff location and fire alarms are operated on the coloured lamp code system. A liberal provision of lighting points is necessary for display purposes. The connected load of showcases and glass serving counters may assume large proportions. Plug and socket connection with local control allows for departmental changes, while double ended striplite lamps with reflectors are most efficient at present. Initial and subsequent maintenance costs prohibit the use of architectural tube lamps. For windows direct light from ordinary lamps in projecting reflectors still seems the best method, with 100 W per 15 in. of window length having a depth of 6 ft., which provides an intensity of 60 lumens. Asbestos flexible cable in conduit is the most suitable type of window wiring.

Electric Cooking

That electric cooking is the cleanest method is not open to question, but there is some divergence of opinion about maintenance cost. In the main the use of electricity tends to reduce running charges, but that argument is not sufficient to justify its use. The strong hold of gas upon the kitchen will not be relaxed until satisfaction can be guaranteed to the user. Supply authorities and manufacturers should seriously consider jointly placing definite and authentic information at the disposal of the public.

Provided the cost per kWh does not exceed one-twelfth of the cost per therm of gas, Mr. Waygood considers the electric kitchen (on cost alone) to have a distinct advantage, the other amenities being too well known to need repeating.

He briefly describes a kitchen with a total load of 300 kW, apart from food-preparation machines, remarking that too many manufacturers who build the motor into the driven machine seem prone to forget that the switchgear also should form an integral part.

There is a tendency to rely more on escalators as the principal means of transport in a store, with lifts for express traffic from the lower to the topmost floors. An escalator travelling at 90 ft. per minute is capable of dealing with 5,000 passengers per hour, whereas one lift of average size designed to travel at 450 ft. p. m. would deal with only

1. A good example of store lighting. 2. An electric kitchen. 3. Hairdressing department. 4. Calorifiers and hot-water arrangements

1,000 passengers per hour. Maintenance and running costs are in the ratio of two to one in favour of escalators.

According to Mr. Waygood the most comfortable speed for floor to floor service is 350 ft. per minute, while for goods lifts 100 ft. per minute meets average needs. For speeds of 300 ft. per minute and over, particularly for passenger service, the gearless machine with automatic levelling is preferable. Average consumptions per car-mile are 10 to 12 kWh for a gearless system and 18 kWh for a straight a.c. geared system.

Incidental Power

For display purposes movement is essential and accounts for a large proportion of the power demand. For instance, one illuminated sign was made up of 4,300 lamps with a load of 80 kW.

Cash transactions must be speedy, aided by automatic mechanism. Motor-driven cash desk receiving and despatching belts travel at 400 ft. per minute, while air tube carrier plant is motor driven and divided into units under automatic control with pre-selector switching.

Electric ironing also provides a share of load. Trailing flexible connections should be discouraged in favour of plug-in heating stands from which the irons are withdrawn for use. Synchronous a.c. clocks have reached a high standard of perfection, but for buildings in which the mains are made "dead" when the premises are closed impulse secondary clocks controlled by a master clock are more reliable. From the maintenance point of view parallel wiring is preferable to the series system.

For hairdressing appliances the average circuit loading is 1 kW per cubicle and the weekly consumption is 1,300 kWh, which is 3 per cent. of the total load.

Steam is used extensively and Mr. Waygood considers the mechanically coal-fired "Economic" boiler plant to be most suitable, motor driven with automatic electrical control. Refrigeration and ventilation also play important parts.

The G.P.O. endeavours to study the telephone needs of the public. Can it offer special terms to large users? Broadcasting and music relaying equipment have added to the amenities of shopping centres.

Load Analysis

In 1934 throughout the five stores with which Mr. Waygood is associated (Messrs. Lewis's, Ltd.) a maximum demand of 4,200 kW was reached. They used 11 million kWh for lighting and power, and 50,000 electric lamps; the total installed h.p. of motors is 9,300. The load is analysed in the following table.

Analysis of Electricity Consumption Per Cent.

	Spring.	Summer.	Autumn.	Winter.
Window lighting	8.1	4.5	6.8	7.4
Hairdressing	2.7	3.4	3.1	2.7
Escalators	3.4	3.8	3.65	3.2
Goods lifts	4.2	3.9	3.45	3.6
Passenger lifts	5.4	5.8	5.9	4.3
Cash tubes	3.6	3.6	4.1	3.3
Heating and ventilating	7.6	8.8	8.8	5.6
Sundry power	10.0	10.6	9.2	14.0
General lighting	55.0	55.6	55.0	55.9

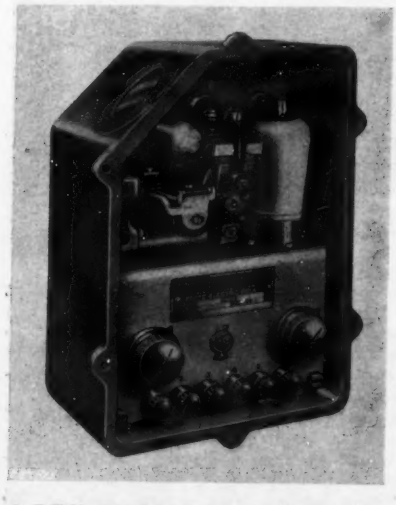
To handle traffic in the stores 119 lifts and escalators are used. It is estimated that the lifts travel 57,000 miles and stop 17,000,000 times in the course of 12 months. Taking the retail trade as a whole, the average consumption in kWh of each store is in the region of 300,000, which is equivalent to the demand from approximately 200 householders using electricity for lighting and power purposes. The range of consumption is from 3,000 to 8 million kWh per store and, since the bulk represents lighting, the power factor is a good one.

Considering the great number of people who each year amble through the stores all over the country, Mr. Waygood asks, could not the Electrical Development Association make greater use of them for bringing home to the public a better knowledge of the uses of electricity and equipment available?

Photo-electric Control of Street Lighting

EXHAUSTIVE tests carried out in many large towns, especially in the U.S.A., have demonstrated the advantages of controlling a street-lighting system by the prevailing natural lighting conditions only. A simple form of time-switch in conjunction with photo-electric control will enable some of the lamps to be switched off during some part of the night.

The photo-electric relay can be obtained with two independent adjustments, so that switching off may be set to occur at a lighting intensity differing from that at switching on. To obviate the risk of chatter at the operating times the ratio of "off" to "on" intensity is about 1.5 to 1. As the change-over of control takes place immediately the relay has operated the off intensity has to be higher than the on, unless expense is incurred in providing a time delay between the change-over.



A B.T.H. photo-electric relay for the daylight control of artificial illumination

Tests on cells exposed for four years to daylight have indicated that the response changes very little provided they are shielded from direct sunlight. The response is proportional to the light intensity at the cathode and when it is dark the photo-cell current is negligible.

The essential components of the photo-electric relay made by the British Thomson-Houston Co., Ltd., are a transformer (when used on a.c.), a sensitive relay, a small contactor, on-and-off adjustments, a photo-electric cell and an amplifier valve. These are carried on a pressed-steel panel housed in a cast aluminium-alloy box with photo-cell window inclined at 45 deg. By withdrawing two screw plugs adjustments can be made in the rheostats by a screwdriver without removing the cover. The box is provided with holes screwed for conduit and two fixing holes for mounting purposes. For a.c. supplies taps for the usual voltages are brought out to terminals.

"Mercra" lighting that is controlled automatically by photo-electric relays

The cell current produces a potential on the grid of the amplifier valve which is a function of the light intensity. This potential opposes a fixed potential set by the adjustments, and so the valve anode current rises or falls with an increase or decrease in light intensity. The sensitive relay is energised by the anode current, and the contacts on this relay control a small contactor which in turn controls the lighting circuit. The "off" control provides a means of compensating for the possible effect of artificial illumination on the photo-cell when lights are switched on. The range of adjustment is approximately 0.2 to 10 ft.-candles, but for interior lighting the upper limit can easily be extended.

A standard contactor will carry 7.5 A at 250 V a.c., and the consumption with a.c. is about 15 W per hour with contactor energised and 8 W with contactor de-energised. A record of operating times over a year in respect of the photo-electric controlled "Mercra" installation outside the B.T.H. Rugby works showed a frequent variation of twenty minutes (and sometimes much more) above or below the fixed schedule. During this period no adjustment was made to the equipment, which has now been in continual operation for eighteen months, and the life of both photo-cell and valve has been approximately 13,500 hours.

Meetings and Discussions

Loading the Grid: Illumination Progress: Encouraging Off-peak Supplies

How the Grid is Operating

In his presidential address to the Association of Supervising Electrical Engineers in London on October 15th Mr. H. Hobson, commercial manager of the C.E.B., surveyed the objects of the national grid and the methods that had been adopted to achieve them. He explained that the national interconnected transmission system was to-day deriving its supplies from about 130 selected generating stations in which it had already been possible to concentrate over 90 per cent. of the total production. The extent of the economies that could be made by the C.E.B.'s method of control would be realised from the fact that during the month of August nearly three-quarters of the whole of the electricity required for the South-East England area (extending from Peterborough to Brighton and from Reading to the east coast) was produced in three large riverside stations. The average consumption of coal at these three stations was less than 1¼ lb. per kWh sent out.

Last year, he said, the Board made arrangements for the installation of over half a million kW of new generating plant at selected stations, and the average size of the individual machines was nearly 40,000 kW, which was four times the average size of a complete generating station some ten years ago.

So far the growth of electrical output in the country had exceeded the estimate used in the calculation of the Board's tariffs, and there was thus good reason to believe that the finances of the grid scheme would be placed on a level keel even earlier than was anticipated.

The operations of the grid had already enabled some distributing authorities to reduce their prices and as time went on that downward movement of prices, in particular for power, would continue to spread. How rapidly it would spread must depend in a large measure on the extent to which industry availed itself of the public service. Certain industries required large quantities of low-grade heat or produced surplus gas or waste heat as a by-product of their operations, and it would be demonstrably uneconomic not to install generating plant to make use of those resources. Such cases were, however, in Mr. Hobson's opinion, less numerous than was often supposed and careful investigation was required before a correct decision could be made.

Mr. Hobson claimed that over the greater part of Great Britain to-day the public supply authorities were in a position to provide electricity at prices which compared favourably with the costs of privately owned power plants. Not all of them were doing so, and it was recognised that the organisation of the distribution side of the industry had not yet reached finality, but that aspect of the matter was now under consideration.

* * *

Lighting Developments and Progress

The opening meeting of the 1935-36 session of the Illuminating Engineering Society took place on October 8th in the reconstructed London Lighting Service Bureau.

Apart from the Bureau demonstration equipment there were exhibits by the Society comprising thirty-one items. These included special novelties in lamps, improved street-lighting equipment, photometry instruments, and miscellaneous fittings, contributed by E.L.M.A., the N.P.L., Home Office Industrial Museum, and the following manufacturers: Philips, Siemens, Holophane, Edison Swan, Benjamin, Everett, Edgcumbe, G.E.C., Claude-General Neon Lights, and Mek-Elek.

The yearly progress report of the Society's Technical Committee records a noteworthy development in the production of a new (Philips) water-cooled super-high-pressure mercury lamp (which is described on page 525). A lamp of somewhat lower rating, functioning in air and not water-cooled, has been also produced.

A new development of considerable interest is the introduction of a new (Siemens) lamp which utilises the resistance of a tungsten filament instead of a choke coil to stabilise the discharge, thus obviating the need to introduce condensers for power-factor correction. The lamp can be inserted in any G.E.S. holder without any alterations in wiring being necessary. In addition, the use of the tungsten filament provides a considerable amount of radiation at the red end of the spectrum, and effects a substantial improvement in the colour of the light.

Advances have also been made in the design of discharge lamps yielding blue, green, and yellow light, and tubes using neon gas to furnish light of a red colour. The latter operate on a normal a.c. supply at 200-260 V and are controlled by a suitable choke.

Coiled-coil lamps are now available in the 60-, 75-, and 100-W sizes as well as the 40-W size first marketed. The increased light output of these lamps compared with those of single-coil construction varies from 10 per cent. for the 100-W lamp to 20 per cent. for the 40-W.

While no great advance in industrial lighting has taken place there have been numerous new installations of interest and improvements in existing installations. Increased use is being made of lamps of high power, but the installation of suitably designed reflectors is still apt to be neglected, with the result that glare is prevalent.

The use of local lighting, supplementing general lighting, has increased, especially for certain processes requiring exceptionally high illumination. The use of low-voltage lamps in miniature reflectors in order to illuminate strongly parts of machines that cannot be easily lighted by other methods is becoming more usual, such special units being not infrequently incorporated in the design of the machine.

In public lighting a feature has been the extension of use of high-pressure mercury-vapour electric-discharge lamps. It is estimated that there are between 6,000 and 8,000 of these in use in this country lighting about 200 miles of public roads.

The design of aerodrome floodlights has undergone considerable development. Whereas an illumination of 0.15 ft.-candles on a surface normal to the floodlights beam was formerly used in defining the area on which the illumination was adequate for landing, a value of 0.19 ft.-candles is now considered desirable.

For the celebration of the King's Silver Jubilee the total load for electric floodlighting was in the neighbourhood of 50,000 kW. Arrangements have been made whereby the apparatus for floodlighting certain public buildings in London shall be permanently available.

In his presidential address Mr. A. W. Beuttell said that the lighting industry had reached a mature stage in its career. It had, so to speak, gone into business for itself, undertaking full responsibility in its own field.

[Lafayette

Mr. A. W. Beuttell, President of the Illuminating Engineering Society

Hardly any other industry had so much cause for optimism and confidence in its future. There would be a continuous demand for more light until the deficiency between the natural and artificial had been made good.

The consuming public would probably be unable to pay for so much more light at its present rate, but the increasing economy with which energy could be converted into light, enabled the extra quantity required to be supplied practically without further cost. Experience showed that as the public became more appreciative of the benefits of good lighting it was prepared to spend more and more in that direction.

The demand for artificial light up to the standard of natural light might yet be solved economically. It was a mistake to recognise impossibilities until they were proved to be such and one must free one's mind from some limiting notions of the past. Thirty years ago the carbon filament gave 3½ lumens per watt. To-day gasfilled lamps with tungsten filaments give continuous spectra around 15 lumens per watt. Vapour discharge lamps gave up to, say, 70 lumens.

Lighting technique was growing accumulatively beyond the command, and even the comprehension, of some who, though engaged in other or composite trades and professions, had to undertake it. The remedy must be for them to employ specialists, but, because lighting was so intimately involved in their problems, they could not wholly give up the study

of it. Therefore they might be expected to join with the Illuminating Engineering Society for the purpose of obtaining the necessary knowledge and to that end educative facilities should be made available for them. For this a policy was wanted, not of the few, nor of a section, but of the industry.

There must be more concentration on the corporate side of the industry as a whole. The Society seemed to require strengthening, not with regard to its own private affairs, but in its possible influence upon the industry generally. The younger members must become more active in the corporate sense and more articulate. Many industrial leaders now absent from the Society's counsels should be with them. Too many organisations were out of touch with the activities of the Society.

* * *

Encouraging the Off-peak Load

IN his inaugural address as chairman of the North Midland Centre of the INSTITUTION OF ELECTRICAL ENGINEERS at Leeds on October 15th Col. H. C. Fraser spoke of load building, with special reference to "off-peak" supply, which he considers to be the most promising field for disposing of energy coincident with complete utilisation of invested capital in plant and mains.

Time diversity affects all parts of a system. For instance, where the annual load factor of the generating plant is 33 per cent., that of the individual transmission mains and sub-stations is 22 per cent., and of the individual distribution networks only 15 per cent., while the average of the consumers' load factors may be as low as 12 per cent.

Moreover, as the total of the economies which result from the improvement of load factor of any part of an undertaking depends on the capital expenditure concerned, it is important to note that the proportion in most undertakings is of the order of 35 per cent. on the generating stations, 25 per cent. on the transmission mains and sub-stations, 30 per cent. on distribution mains and services, and some 10 per cent. on other works, and that the expenditure on transmission and distribution works continues to show an upward tendency.

Whereas December afternoon peaks vary considerably from day to day, both in extent and time of occurrence, the morning peak is almost stationary between 7.30 and 8.30 a.m. and is undoubtedly largely due to breakfast-time domestic load. It will become more important, and in this connection the Monday morning peak is of particular interest, since the maximum power and heating loads usually synchronise during this period. The individual loading of factory installations is often 20 per cent. above normal after a cold week-end, due mainly to increase in oil viscosity when machinery is idle, and this adverse effect does not subside until 10 a.m. In addition, Monday is washday, and wash-boilers and immersion heaters add their quota to the usual heavy demand created by fires, water heating, cookers and lighting during the breakfast-time period.

In the case of large base load stations the actual coal cost will amount to less than 0.09d. per kWh, and, after making due allowance for transmission losses, an all-in cost of 0.1d. per kWh will form a reasonable cost basis for off-peak loads, when little capital expenditure is incurred in giving a supply. The greatest difficulty will be not in finding consumers, but in deciding to whom the facilities are to be offered. As the available "off-peak" energy is a limited quantity, it will be in the best interests of the undertaker to confine special facilities to profitable spheres of application which cannot be served in the ordinary way owing to severe competition from other sources of heat and power.

Domestic water heating is one of the most promising fields and on a conservative basis of 2 kWh per person per day will go a long way towards absorbing all available "off-peak" energy. An "off peak" control system will make possible the production of an effective thermal storage cooker, which will not only eliminate demand charges, but will also remove such inherent defects as excessive heat inertia and cooling off losses.

Col. Fraser declares that recent extensive interruptions of supply have had serious repercussions in destroying public confidence in electricity, and in this respect the thermal storage principle will be of great value in providing a reserve of heat to carry over a period of interruption, and will also facilitate the work of the supply engineer in permitting, without serious consequences, a reduction in load in the event of a partial shut-down.

For space heating in large buildings difficulty may arise in justifying the adoption of electricity on a purely thermal comparison. Col. Fraser favours electrode or resistance boilers and also considers that controlled horticultural supplies should play a great part in future development.

The reluctance of industry to dispose of existing moderately efficient plant at scrap value can be dealt with most advantageously by arranging for an interchange of supplies during critical winter months, and the additional security of supply provided by such a working arrangement will often strongly appeal to the user. Another important field needing development is that of pumping provided with storage facilities.

Adequate control requirements can only be satisfied by some form of superposed high-frequency control, and Col. Fraser is confident that a system of this kind is practicable and will, when available, form a sound basis for future development of "off-peak" load.

Progressive control action is essential to provide a gradual transition from one state of load to another so as to follow the contour of a system load curve, and without this feature little improvement in load factor can be achieved. In addition, selective action will, by taking advantage of diversity in demands for heat or other stored medium, permit the connection of a large proportion of "off-peak" load without inconvenience to consumers and with the minimum of thermal storage. This feature would be of particular value in making possible the design of an effective thermal storage cooker.

* * *

Transport Co-ordination

STARTING from what he stated to be the generally accepted basis that some degree of compulsory, or what he called induced, co-ordination and co-operation was to be preferred to unregulated competition in the conduct of the public utility of transport, Sir Cyril Hurcomb endeavoured to describe the progress that had been made in this direction in his presidential address to the INSTITUTE OF TRANSPORT in London on October 14th. The Minister of Transport, he said, had exercised his power of requiring standardisation in one important respect (with the assent of the owner companies), namely, the standardisation of methods of railway electrification and electrical equipment.

Nearly ten years after the amalgamation and re-organisation of the railway system the comprehensive co-ordination of public passenger transport was undertaken; first, generally throughout the country with regard to omnibus and coach traffic under the Road Traffic Act, 1930; and, secondly, through a measure initiated in 1931 and passed two years later by complete re-organisation of all the means of public passenger transport in Greater London.

In yet another direction public passenger services by road had been advanced by the co-ordination of municipal undertakings and other operators, including the railway companies, through joint committees, of which Halifax was a good example. The Corporation provided services, not only for the area of its own borough but for fifteen local authorities outside, and its tramways covered nearly forty route miles. As a result of this scheme five tramway services had been discontinued and replaced by motor omnibuses and two branch railways had been closed, the passenger traffic being transferred to the omnibuses of the joint committee. This showed the possibilities of a redistribution of function between the different forms of transport where common financial interest had been established.

* * *

Mining Electrical Engineers

The rapid development of mining electrical engineering during the past few years and the need for efficiently trained engineers to attend to the ever-increasing new plant were the two main points stressed last Saturday by Mr. H. Williams, of Cardiff, on the occasion of his installation as president for 1935-36 of the South Wales branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS. In view of the continued depression in the coal trade Mr. Williams made a special appeal to members of the Association to do all in their power to assist the colliery companies in effective economies by making use of electrical plant to increase output and thus decrease costs. It was indisputable, he said, that Great Britain excelled in the direction and provision of mining electrical plant.

Installation Inspection

Mr. T. M. Buist, of the Edinburgh Corporation Electricity Department, speaking on "Electrical Inspection" at a meeting of the EDINBURGH ELECTRICAL SOCIETY on October 9th, expressed the opinion that practically all fires attributed to electricity were caused by unskilled fitting and carelessness, and that the risks would be nullified if regulations were strictly adhered to in all cases. Mr. Buist indicated how greatly the scope of electrical testing and inspecting had increased during the last twenty years. In 1914 the number of inspections was 1,508, and in 1934 the comparative number had risen to 10,706. He stated that in a number of places of entertainment and elsewhere extraordinary liberties were taken in the use of temporary wiring by unqualified persons.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication.

Corporation and Contractors at Croydon

You report on page 440 of your issue of October 4th the protest by the electrical contractors of Croydon against the Croydon Borough Council's decision with regard to the sale and hire of electrical apparatus. I am particularly interested in Mr. Penwill's statement that "With such favourable terms as the Corporation offer contractors cannot sell the same type of apparatus," *i.e.*, cookers.

For Mr. Penwill's information I have been looking up a questionnaire which was prepared some time ago, and I notice that where hire-purchase of cookers only is in operation, there are only some hundreds on the mains as compared with thousands in other cases, where simple hire is available from the undertakings.

Hire-purchase of cookers was the rule in the Borough of Poplar until the beginning of 1935, the hire-purchase terms being equal to those of any other borough in the country, but the total number of cookers on the mains was only thirty. I then launched a scheme of simple hire of cookers and wash-boilers in January, and the total to date connected to the mains in exactly nine months is 2,340 cookers and 780 wash-boilers, giving a connected load of 13,760 kW.

In the circumstances it is evident that Mr. Penwill's views on electrical development are somewhat early Victorian. Furthermore, there is a committee sitting at the moment to investigate the distributing side with a view to speeding up the loading of the grid system, and I think that if Croydon follows the lead of Poplar, it will find out which is the quickest method of attaining this object.

R. ILLINGWORTH,
Bromley-by-Bow, E.3, *October 8th.* Poplar Electricity Dept.

From the report appearing under the above heading in your paper for week ending October 4th it would appear to the writer that the Electrical Contractors' Association has missed the main issue when it says that it cannot compete with hiring schemes such as that in vogue at Croydon.

Records recently published show that it is only when such apparatus as domestic cookers is energetically pushed and backed up by simple hire schemes with attractive charges for the consumer that any progress can be made by a local supply authority. All such growth of an electricity undertaking must surely bring in its wake increased business for the contractor. A householder satisfied with electric cooking will undoubtedly seek other electrical labour-saving devices, and it is into this field that the contractor should be ever ready to step and make additional sales.

To my mind there is apparently one very vital aspect of this question that the contractors have not given any consideration to at all, and that is, that to-day electricity supply is one of the modern social services that should be available for every household, irrespective of whether they be middle-class or working-class. In order to push this to its fullest extent, schemes such as the simple hire of cookers with up-to-date maintenance facilities must be available. Any hire-purchase scheme in which the contractors participated would, I am afraid, merely retard the growth of the electricity undertaking generally, and the subsequent result would undoubtedly be a slump in the contractors' own particular business.

So far as I can see the Croydon Corporation has always been very sympathetic towards the contractors in its area, and even under the new proposed scheme it is quite possible for contractors to obtain at least the wiring of a cooker, and the suggestion put forward I think should act as an incentive to all contractors to obtain new cooker consumers for the supply authority and increased work for themselves.

There are many other difficulties which the contractors, I am sure, have not considered when discussing the question of hire-purchasing such heavy consuming articles as electric cookers, and in my opinion they should adopt an attitude of co-operation and not one of obstruction, as the efforts contained in the article mentioned would suggest.

I cannot help but think that the cry of "Wolf!" is decidedly applicable in this matter, for I feel that it is quite possible that many of the contractors realise their own inefficiency when it comes to a question of developing cooker sales on such lines as to justify the heavy expenditure upon the grid, and also to meet the requirements of the local potential consumers.

It would certainly be to the advantage of the local contractor to work wholeheartedly with the engineer and profit by the natural growth and the prosperity for the trade that will naturally follow.

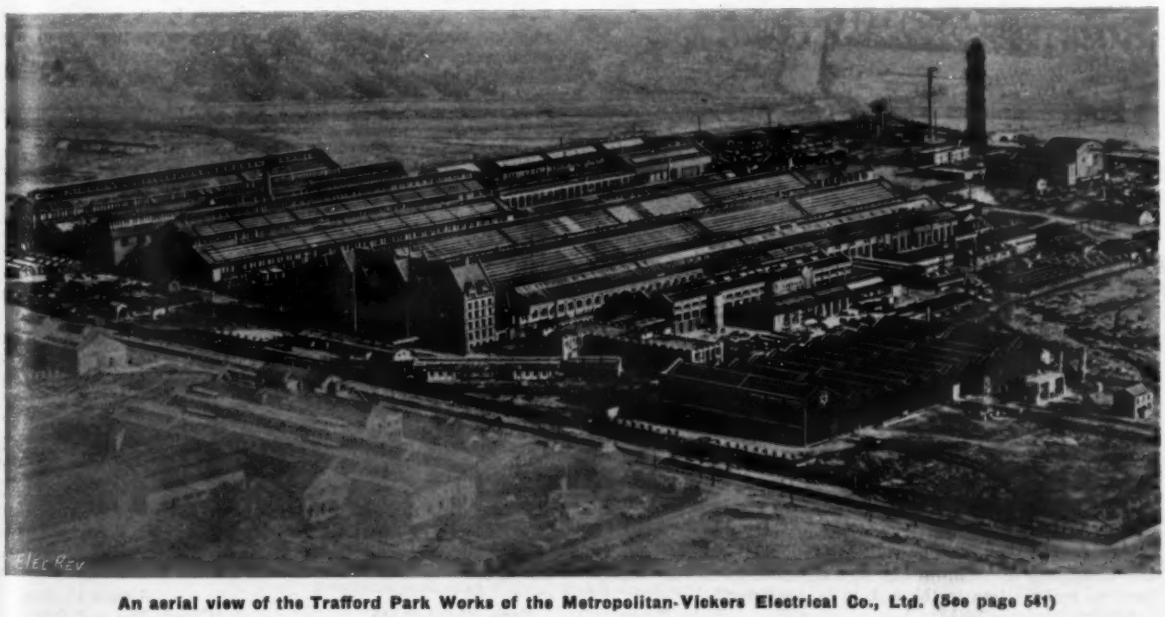
SALENG.
October 14th.

Ships' Electrical Installations

Referring to Mr. Johnston's letter in your issue of September 27th relating to certain parts covered in my recent paper on ships' electrical installations I would reply as follows.

Mr. Johnston indicated that he had not read the full text of the paper in which the following complete statements occur in connection with oil-engine generators: "Difficulties associated with high piston speed and torsional oscillation have been encountered and are being gradually overcome." . . . "Units of this type having a capacity of 300 kW at 900 r.p.m. are being manufactured at the present time for marine service, and their performance in service will be watched with considerable interest. . . . The successful performance of generating plant of the order of 300 kW installed in several ships where the Diesel engine speed is 500 r.p.m. indicates the progress made in Diesel engine technique and suggests that low rotational speeds may be safely discarded."

Regarding the average sea load Mr. Johnston gives the figure of 0.25 kW per person for ships equipped with steam-driven auxiliaries, a condition not relevant to the paper, which is dealing with ships equipped throughout with electrically driven auxiliaries. The figure of 1.5 kW per person for the latter type of ship suggested by Mr. Johnston is rather higher than I have met in my own experience.



An aerial view of the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd. **(See page 541)**

As to the question of aggregate auxiliary plant the extract suggested by Mr. Johnston is not in complete accordance with my text which is as follows: "The auxiliary plant installed in the electrically propelled ship is of roughly twice the aggregate power of that fitted in the cargo liner."

In my paper comparison was made between ships of the liner class, viz. (1) an electrically propelled liner in service equipped with generating plant of 2,000 kW; and (2) a cargo motor liner of approximately the same length but equipped with generating plant of 1,070 kW.

The final reference to which Mr. Johnston takes exception is recorded in the paper as follows: "Electrical requirements vary considerably with the type of ship and nature of the propulsion unit. Thus a steam propelled ship of 8,000 tons may require electrical plant of 50-kW capacity only, whilst a motor ship of similar size equipped with electrically driven auxiliaries may require from 500 kW to 700 kW of electrical generating plant."

In the last paragraph comparison is being made between ships of the freighter class only, with no passenger accommodation. Whilst one usually associates steamships of 8,000 tons with cargo work I agree with Mr. Johnston that this might have been made a little clearer. H. G. Leivesley.

Manchester, *October 10th.*

Illumination Values

It is clear from Mr. Barton's letter in your issue of October 11th that he has misunderstood the point of my article. My argument is directed rather against excessive artificial illumination than in favour of low illumination. He will not find any support for old-fashioned conical shades or uneven distribution, which I should join him in condemning. Indeed, my first sentence admits the existence of much bad lighting. I have not argued that tool-makers do not need much higher intensities of illumination than clerical workers. They do, because their work involves the perception of fine detail under conditions of low contrast, and on material which is generally of low reflection factor. These points have not yet been investigated by the unbiased scientific committees, the facts of whose findings I quoted.

I am surprised that Mr. Barton finds 30 ft.-candles an uncomfortably low intensity for clerical work. One rarely finds intensities of this order even in a well-lighted office, except close to a window. For the benefit of the layman who does not often use a photometer, may I explain that 30 ft.-candles is approximately the intensity of illumination at a distance of 30 in. from a naked 200-W gasfilled lamp.

My personal experience is that 4 to 5 ft.-candles is comfortable for ordinary clerical work, and that I can use a slide rule (fine detail) without any sense of strain under 10 ft.-candles, provided that there are no other much brighter objects in the vicinity. As I still have no need for spectacles when most of my contemporaries wear them I cannot be straining my eyes. I agree, of course, that there is a considerable personal variation in this matter.

Mr. Barton will no doubt remember that a few years ago the Department of Scientific and Industrial Research published Technical Paper No. 12 on the daylight illumination required in offices. In that report the findings of a number of well qualified observers, not interested in the sale of lamps or electricity, are quoted for a number of offices. They determined the daylight factor which was on the border line between adequate and inadequate illumination. The average found by all observers was just under 0.2 per cent. and the maximum of any observer in any office on any day 1.0 per cent. There was evidence that the value varied with the outside illumination, but on an average dull day these figures would correspond to illuminations of 1 ft.-candle and 5 ft.-candles respectively. I agree that these are minima but they are very far from 100 ft.-candles.

There is one other angle from which we can consider the problem. In some experiments quoted by Luckiesh & Moss, the size of the pupil of the eye was measured when it was exposed to various intensities of illumination on a surface of 80 per cent. reflection factor (as, for example, white paper). It varied from about seven millimetres at 0.01 ft.-candles to two millimetres at 1,000 ft.-candles, these dimensions being near the limit of adjustment in each direction.

It would be quite logical to assume that the most comfortable intensity of illumination would be that corresponding to the mean aperture, when the muscles of the eye were not strained to adjust the iris to either extreme position. This would correspond to an intensity of about 3½ ft.-candles (the variation is not linear). Of course, the same pupil opening would correspond to much higher intensities if the reflection factor of the object observed were much lower.

May I reiterate that I am not arguing in favour of general low intensities of illumination, but against high levels, which have no real relation to the task to be performed.

Radlett, *October 14th.* T. N. Riley.

I agree with Mr. P. J. Barton that reasonably high values of illumination are necessary and in practice where work is to be carried out dim lighting of the order indicated by Mr. Riley would be inadequate.

My concern has recently designed a lighting installation for a departmental store, which is lighted at 50 to 75 ft.-candles without any glare and without any discomfort. The proprietors say that this is the first time they have ever had good lighting. I find that for fine work intensities over 100 ft.-candles are accepted as comfortable and superior to lower intensities. L. C. Grant.

October 14th.

Why Gas Sometimes Wins

At times we hear quite a deal as to the way in which gas continues to hold its own in the public favour. Perhaps my own experience may do something to explain how this comes about. It would seem that the gas people have a valuable ally in the electricity supply authorities.

Owing to a variety of causes, I recently had to take the first house offered, with the result that after over thirty years' experience and connection with the electrical trade, I found myself in a "gas" house. A week or so after we moved in a canvasser from the electricity company called and left a form explaining the company's rental wiring scheme. After examining this I filled it in and signed it. The immediate result was that a man called and measured up the premises, and explained the position regarding extra points required. Then silence for over a month.

Now I have received a letter thanking me for my application (lodged at their invitation, mind you!) and informing me that as there is no main available, there is nothing doing. No, we are not in the backblocks, but in one of London's most populous suburbs, a few yards from the main road, in a house built about thirty years ago, and where no building has been done for over twenty-five years owing to the area being completely built up. It is safe to say that were a main run up this road 75 per cent. of the houses would be connected at once.

As it is, it is Eldorado for the gas company. Good luck to them; they do give service. H. W. Stowers.

Norbury, S.W.16, *October 13th.*

The Nearly-all-Electric House

Mr. H. C. Gostick appears to be satisfied with a fuel-electric service at a cost of 8s. 1d. per week for a family of four persons. This example will not do. What about the masses? I have found the most economical system to be an efficient coal or coke range with flue-back boiler, indirect hot-water cylinder, with hot-water radiators for bedrooms, electric wash-boiler and electric light.

The flue-back boiler can be efficient as judged by the cost of the service, in the following example of a house with four inhabitants containing three bedrooms, bathroom, sitting-room and scullery:—Heating, cooking and hot water, 2s.; electric wash boiler, 4d.; lighting, 6d.; which gives a total of 2s. 10d. per week.

For the masses, in my opinion, the cost of all services should be 3s. per week, including a liberal supply of hot water. Electric heating for bedrooms in the event of sickness (which unfortunately every household experiences for prolonged periods at some time or another) means continuous heating of one small room which at ½d. per hour costs 7s. per week.

Bury, *October 8th.* G. Marshman.

Lamp Research in France

Your issue of August 9th contained an article under the title "Lamp Research in France," which deals with our researches on krypton and xenon incandescent lamps.

Certain parts of this article do not agree with the facts and with the documents which we have published on these researches and which we are pleased to hold at your disposal. For example, the percentage of xenon which is the most favourable is between 5 and 20 per cent. and not between 15 and 20 per cent., as stated.

This, however, is only a minor error in comparison with the statement in the last paragraph that the "utilisation of these gases is not considered commercially practicable on account of their *rareness.*"

The quantities of gas which can be produced are unlimited, since the raw material is the atmosphere. The new process permits the production at a moderate price of krypton and xenon from large quantities of air through washing by a small quantity of liquid air. The cost of the gases contained in an incandescent lamp is negligible in comparison with the economy of electricity resulting from the higher efficiency of the lamp.

André Claude (Claude-Paz and Silva).

Paris, *October 8th.*

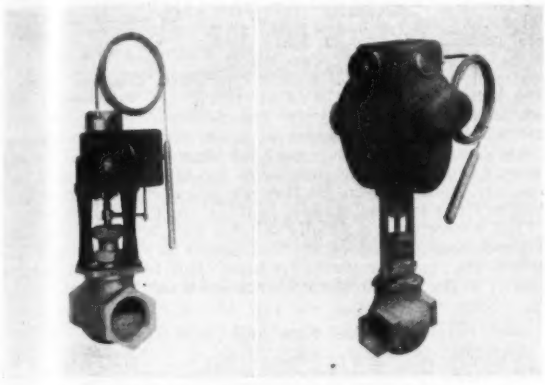
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Motorised Inching Valve

By means of a specially built-on thermostat, a motorised inching valve introduced by the British Thermostatic Co., Ltd., Windmill Road, Sunbury, Middlesex, combines the restrictive qualities of the thermostatic valve with the positive action and greater reliability for large installations of the motor-operated valve. This makes reliable operation possible even with a very fine working differential.

The thermostat, which, instead of a mercury tube, has a main arm fitted with double spring loaded contacts, takes up a position according to the temperature at the phial and causes the valve to open and pass a certain quantity of steam. The valve motor itself is operated by the contact on the end of the rod attached to the valve spindle by a screw thread of the same pitch as that operating the valve itself. This contact is in between the two contacts on the arm of the thermostat, so that as the arm moves upon a contraction of the bellows the bottom contact operates the valve, while as the temperature rises and the bellows expand the top contact does so. Thus when the temperature falls the valve opens slightly and allows more steam to pass, while if the temperature rises too rapidly the valve will close again until it finally takes up a position to keep the temperature as nearly constant as practical conditions will allow.



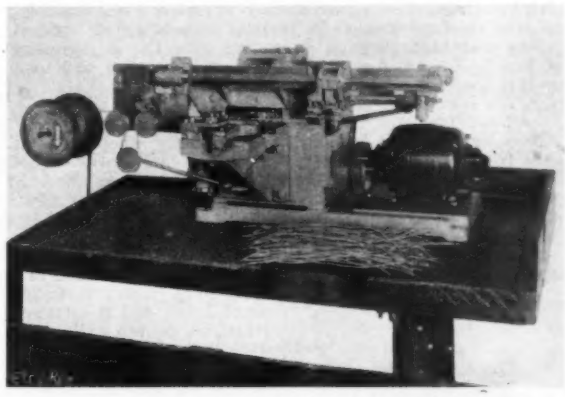
Two views of the motorised inching valve

Automatic Measuring, Cutting, and Stripping

A new machine introduced by Messrs. G. E. Marbaix, Ltd., Vincent House, Vincent Square, London, S.W.1, takes the wire from a coil or reel, measures and cuts it to any pre-determined length within the range of the machine and strips the insulation from one or both ends, all in one operation.

The machine consists essentially of a pair of grippers moving to and fro on a slide bar in a horizontal plane, and a cutter head equipped with cutting and stripping blades also operating in a horizontal plane. The pair of grippers takes hold of the wire, pulls it out to the required length for which the machine is set, after which the feeding movement stops. Immediately the cutter head comes into operation. This is provided with three blades on each side of the wire; the two middle blades are the cutting-off blades, and the two outside blades are set in such a manner that they will cut through the insulation but not through the conductor.

Immediately after the feeding clamps come to rest the cutting and stripping blades move together and the cut-off blades cut through the wire. The feeding clamp then exerts an additional secondary motion pulling the wire away from the cutting blade and through the stripping blades, which causes the insulation to be removed from the end. The feeding clamp then opens and releases the wire. The clamp then moves back to the original position on the left and takes hold of the next wire. It then exerts another stripping motion to the left which causes the stripping to be removed from the first end, after which the blade assembly opens up and the strippings are removed by means of knock-out blades.



A measuring, cutting, and stripping machine

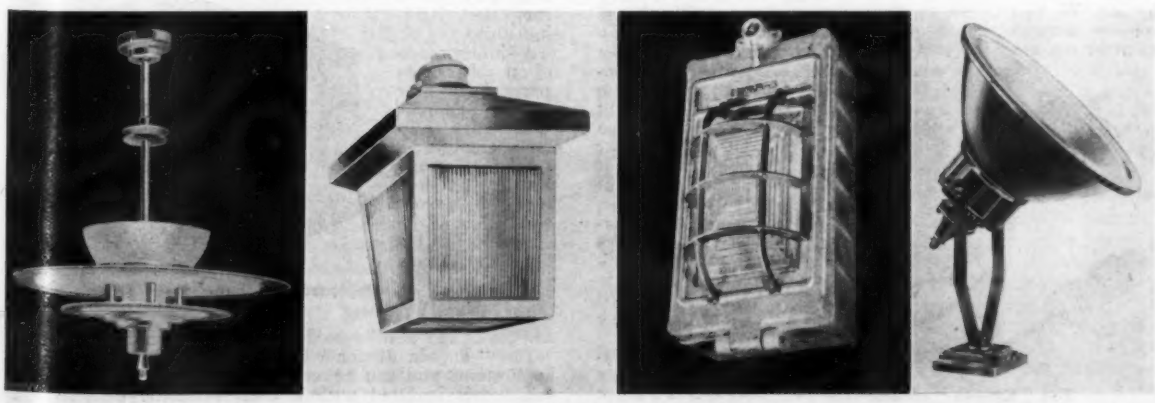
The stripping length can be adjusted on either end of the wire from $\frac{1}{8}$ up to $1\frac{1}{4}$ in. The minimum cutting length is 2 in. and the maximum is 97 in. The production capacity on the "Type C.S.6.E." machine for a cutting range of from 2 in. to 15 in., is 3,000 lengths per hour; down to 500 lengths per hour for a cutting range of from 64 in. to 97 in.

The machine will handle wires from about 0.10 in. in diameter or less, over the bare copper, solid or stranded, and up to about $\frac{3}{4}$ in. diameter over insulation. It can also be used to some extent for cutting and stripping heater cords and parallel lamp cords when equipped with proper stripping tools.

Developments in Lighting Fittings

A large range of lighting fittings has recently been put on the market by the Simplex Electric Co., Ltd., Garrison Lane, Birmingham, 9. These include prismatic refractor fittings in two types, each with 10 in. and 12 in. main panels, for use with 250 and 400-W electric-discharge lamps. The first type ("L.20522") is intended either for direct mounting on lamp columns or for attachment to walls. The main vertical lenticular panels give maximum intensities at an adjustable angle of 75 deg. to the vertical and 160 deg. in plan for illuminating the centre of a roadway. Refractor panels can be supplied to give reduced c.p. in the direction of oncoming traffic. The second type ("L.20521") incorporates a condensing trap and cool wiring chamber and is intended for mounting on projection arms or for central suspension. Light distribution is axial with the main beam.

A lantern for filament lamps ("L.20396") incorporates an open type refractor giving axial or non-axial two-way light distribution, and is suitable for mounting on the kerb or for central suspension.



New "Simplex" lighting appliances: the "Discus"; a lantern for use with high-pressure mercury-vapour discharge lamps; a prismatic bulkhead fitting; and a floodlight projector

New wide-angle floodlights are available for both filament and discharge lamps. Ease of wiring and the maintenance of cool connections are standard features. Prismatic lenses giving rectangular beams and colour filters can be supplied. An all cast-iron fitting ("D.S.40") incorporates a prismatic front lens giving a narrow beam of high intensity with a sharp cut off, making the lamp invisible at wide angles of view. The front is protected by a malleable-iron guard, making the unit suitable for use on traffic islands and on the kerb line. For use in inflammable atmospheres 100-W projectors (L.20587 and 20581) have been designed with 16 in. chromium-plated copper reflectors which can be used with armoured cable or (without strings) for pendant mounting from conduit.

New watertight fittings complying with the requirements of B.S.S. No. 238 for mines are offered complete with connection boxes for armoured cable. Two prismatic bulkheads with c.i. bodies are also recent developments; "L.891" has a screw-on front and "L.892" a hinged water-tight front.

Newcomers to the industrial class are the reflectors in all sizes from 14 in. to 20 in. with canopy and anti-vibration device. Ten new kinds of ornamental fitting have also been produced, and table standards for typewriters.

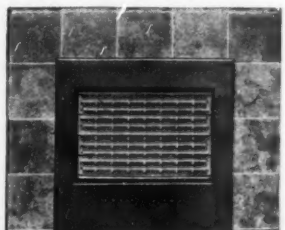
Charging Car Batteries

The "Aco" car battery charger has been designed primarily for the use of the private owner. It is mounted in a steel casing with crystalline enamel finish, and is arranged for hanging on the wall of the garage. Leads are connected to a plug and socket suitably mounted on the car, and by this means the battery can be given an all-night trickle charge. The charging rate is 1 A and the charger is loaded at only 38 W. An ammeter is provided to indicate the charging current, and also a pair of terminals, to which a 12 V inspection lamp can be connected when working on the car. Switches are provided for both charging and lamp circuits. The charger costs £3 15s. and is supplied complete with 2 yd. of flex and adaptor, and full instructions for installation and use. It is made for a.c. mains only, and is available for either 6 or 12 V batteries from the manufacturers, the A.G. ELECTRICAL CO., 28, Station Road, Acocks Green, Birmingham.

The "Aco" battery charger

An Improved Inset Fire

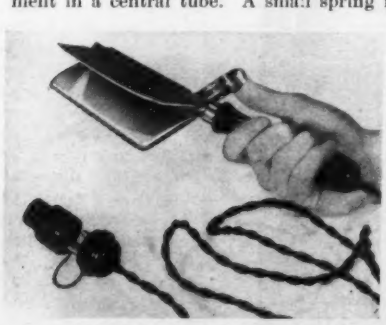
Among a new range of inset fires being manufactured by BRIGHTGLOW, LTD., Oaklands Road, Cricklewood, London, N.W.2, is a model which, in addition to the box back for slabbing into tile surrounds, has an inner back attached to which is a deflector so fitted that hot air from the rear is directed through the opening above the bars. In this way the surround and fire body are kept cool and the decorations clean. Special clips are supplied for marble and terazzo slabs, avoiding the necessity for cementing box backs into these slabs and at the same time eliminating cracking.



A "Brightglow" inset fire

An Electric Creaser

The "Empire" electric creaser is being sold in this country by MR. W. T. DRIVER, 10, Store Street, London, W.C.1. It consists of two chromium-plated blades heated by a 37-W element in a central tube. A small spring maintains the blades normally in contact with each other, but slight pressure on a thumb trigger opens them out an inch or so at the outside edge, enabling a variety of articles from the thick edge of a coat to a thin pleated skirt to be creased.

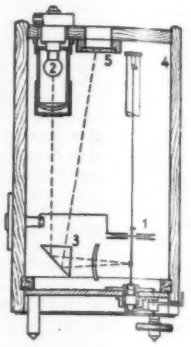


The "Empire" creaser

As the apparatus weighs only 10 oz. and is fitted, as standard, with a combined two-pin plug and lampholder adaptor, it is particularly suitable for use when travelling. Trousers which have lost their crease through being wet can be pressed very quickly and easily. A cheaper model in which the two plates are non-adjustable is also made.

An Electrostatic Voltmeter

A Hartmann & Braun self-contained mirror type of electrostatic voltmeter is being introduced into Great Britain by KANDEM ELECTRICAL, LTD., 711, Fulham Road, S.W.6. This instrument has a range of 0 to 20 V and is suitable for d.c. and for a.c. up to 10^4 cycles. The scale is open from 1 V upwards, the maximum sensitivity being between 2 and 8 V. The height of the case is 9 in. The measuring system is a quadrant electrometer, a small needle suspended from a long metal strip oscillating between plates. Air damping is provided by the needle moving inside narrow chambers coated with a thin layer of insulation which has no disturbing influence on either d.c. or h.f. current but protects the instrument from the effects of short-circuit in the event of contact between needle and plates. The needle comes to rest within 15 sec.



The diagram of the voltmeter

A small lamp (2) is fitted inside the case at the top. The beam of light is thrown *via* an optical system and a prism on to the mirror attached to the measuring system and is reflected by this mirror by way of the prism (3) on to a scale (5). The diaphragm underneath the lamp (2) has a thin black thread which appears on the scale (5) in the form of a dark line. The bottom of the case is fitted with set screws for adjusting the instrument to a spirit level; a locking device protects the movement from damage during transport. Provision is made for zero point adjustment. The insulators are made from calan, and for capacity measurements they are of amber. The capacitance between the terminal sockets is 13 μF for full-scale deflection.

The voltmeter is especially suitable for conditions where the current consumption of the instrument is an important consideration, *e.g.*, for watt-hour-meter and telephone-apparatus testing or for high-frequency work for measuring grid voltage.

A Pocket Saw and Drill Stand

A new development by MESSRS. FRY'S, LONDON, LTD., 24/25, King Street, Royal Mint Street, London, E.1, is the "Enox" pocket saw (No. 28), which comprises three blades and a knife folding into a chromium handle in the same way as an ordinary pocket knife. Other fitments can be supplied if required, such as different pitch blades, or a file can be inserted instead of the knife. Another new introduction is the "Enox" drill stand, made in two sizes. It is a die-cast of zinc-base alloy attractively finished in green cellulose, while the sizes are clearly indicated in gold. The stand can be easily pivoted to a bench or supplied with a handle for carrying purposes, and the holes are die-cast.

Panel Lighting Units

Though primarily for office illumination, the latest flush-type "Hedralite" ceiling or wall fittings made by MESSRS. HOLOPHANE, LTD., Elverton Street, S.W.1, is finding considerable favour for domestic purposes. The panels, which incorporate the company's special reflectors, can be made to almost any size or combination. The visible metalwork is of brass moulding with cast corner pieces and ornamental headed metal screws. The brass frames are fitted with detachable back frames of iron for fixing to the ceiling or wall. Supplied with a sheet-metal box attached to the iron frame for housing the lamps and reflectors, the fitting forms a complete lighting unit.

A similar range of panels made particularly for use in buildings with lofty ceilings employs a special concentrating prism lens which controls the side spread of the light and directs it into the vertical plane. These concentrating plates can also be used in the built-in units.

"Hedralite" panel flush ceiling fitting

The "Pagoda Junior" bracket No. F.9342 has numerous applications and can be mounted either horizontally or vertically. It is fitted with a front prismatic trough and an interior prismatic reflector. The metalwork, which is finished in chromium plate, consists of a deep curved moulding with cast detachable frame and metal back plate.

Electrical Appliances in Argentina

A brief survey of interest to British manufacturers and exporters to South America

A CORRESPONDENT in Buenos Aires reports that although the population of Argentina is estimated at over 12,000,000, the market for electrical appliances is principally in Buenos Aires, which has a population of about 2,225,000, and in some of the larger cities such as Rosario and Cordoba. Electricity is supplied in Buenos Aires by two large companies, which furnish the current from steam generating plants using imported coal. These companies have for some time carried on extensive advertising to promote the sale of electrical appliances, and their efforts are gradually extending the field. In addition to propaganda by large and spectacular electric signs, both the companies maintain up-to-date showrooms in the centre of the city for demonstration purposes.

The basic cost of electricity in Buenos Aires is 25 centavos per kWh (5d. at par). Reductions in this cost are, however, made by special arrangement for installations of stoves, water heaters, refrigerators, and such articles, when a rate of 6¼ centavos is charged. In Buenos Aires and the chief cities the voltage is 220; the supply is 50-cycle a.c. and d.c. The latter is confined, however, to a small section of the city and a few other places, and a change-over is gradually being made.

Local manufacturers have been steadily extending their activities, and at present are in a position to offer a fairly wide range of goods. Except for some notable exceptions, the local products are inferior to the imported variety, and the latter may still be brought in despite the competition from domestic articles. It is to be expected, nevertheless, that in some lines Argentine-made or assembled products may gradually displace foreign-made goods. In most cases the local industry is highly protected by Customs duties, which have been considerably augmented by the depreciation in the value of the Argentine peso and the control of exchange.

Exchange Favours British Exporters

Most appliances are sold through large branch offices of British, American, Swedish and German firms, which import and sell their products in their own retail establishments; their goods are also distributed by retail dealers and department stores. Both the companies referred to demonstrate these products as well as other less-known brands, but they will not handle goods that may not be purchased from local stocks. The larger of the two companies also carries out retail distribution of goods in its own showrooms, while the other maintains showrooms for demonstration purposes only.

A portion of the imports of some smaller appliances is still sold by agents, working on 10 per cent. of the f.o.b. value as commission, and in some cases they carry a small stock to meet sudden demands or to supply buyers unable to import. It is obvious that branch offices of foreign firms are in an advantageous position when competing against such agents, but the latter are sometimes able to offer better prices, and it is on this basis that they continue to take orders. Most of the more expensive appliances may be bought on long-credit terms.

For some time the finish and novelty of appliances made in the United States have been preferred to those of other countries, although the United Kingdom, Sweden, Germany and Italy also obtain a fair share of the trade. Although the prices of German goods are generally lower than American prices, the quality is not as well regarded and is more comparable with locally-produced articles. Importers from the United States, however, are not in a position to obtain official exchange, so it is necessary to pay the full 20 per cent. surcharge upon the official exchange rates when making remittances. On the other hand, official exchange would no doubt be available for imports from the United Kingdom, and probably from Germany. Sweden's position is more uncertain, and it may be that imports from that country must also pay the surtax.

Electric Cooking Popular

Imports of complete electric refrigerators have practically ceased. In addition to several local manufacturers, a number of well-known foreign makes are assembled in Argentina from imported machinery and locally-made cabinets. This assembling is carried out by the branch offices of agents of foreign firms, who contract for their cabinet requirements from two enamelling plants in Argentina. The duty on built-up refrigerators is 1.296 pesos per gross kg. Most apartment buildings now erected are equipped with refrigerators, and a large proportion of the sales of these units is for contract work.

Electricity is being used more and more for cooking in Argentina, and many apartments are completely electrically equipped. The bulk of the imports are from the United States, although the United Kingdom and Germany compete. However, at present there are several local factories producing good electric cookers, and already the branch office of a German firm is manufacturing cookers in Argentina, and it is said that the principal American models on the market will also be made in Argentina soon.

"Rangettes" or small cookers have not so far been introduced. It is doubtful if this type would be acceptable in Argentina as it would be difficult to educate servants to use them properly. In addition, as the reduction in the cost of electricity granted by the electricity supply companies depends on the installation of a special meter and wiring, there is little inducement to install a stove that may be connected to any wall plug. Furthermore, there is no standard load allowed on these plugs, though most installations appear to be designed for 1,100 W, and it would be difficult to manufacture a "rangette" without having some maximum allowable load to work from. The duty on both cookers and "rangettes" is 42 per cent. of the declared value.

Irons and Vacuum Cleaners

Domestic electric irons are one of the principal lines imported. Although there is a certain amount of local production, the quality is much inferior and the two lines do not really compete. Most imports are from the United States; German irons are cheaper, but the lower-priced market is chiefly in the hands of local factories. Argentine-made irons sell retail at 3.80 and 4.50 pesos (4s. to 5s.) each and c.i.f. prices from the United States are about 8s. each, and 10s. and 13s. for irons with heat control.

The principal demand is for the tip-up type of rest, although most shipments include some irons with stands. There is some outlet for irons with automatic heat control, but the higher cost limits their sale. Most imports are chromium-plated 5-lb. irons, but there is also a good demand for 6-lb. irons. United States irons are generally designed for 580 W, whereas the German are loaded at only 480 W. Tailors' irons are also imported in varying sizes, but are mostly supplied by Germany, American prices being too high. It is usual to pack each iron in a corrugated cardboard box before placing it in the packing case.

In vacuum cleaners and floor polishers Sweden still obtains the bulk of the trade, mainly because the Swedish company with a branch in Buenos Aires gives more attention to the development of its sales in this line than other firms. The demand for these articles has improved in recent years, though Customs duties and exchange difficulties restrict sales.

Market for Toasters and Fans

Although there is a certain local production of hotplates, there is still a good demand for imported makes. These are principally supplied by the United States, and some come from Germany. Imports are made both in one and two rings, but the main outlet is for a single-ring plate. Both solid and open types are used, the preference being for the former.

The consumption of toast in Argentina is growing, and with it a fairly good demand fr toasters. These are largely provided by the United States. The automatic type is not generally acceptable; most sales are of simple vertical toasters for two slices of bread. The multiple units for hotel or restaurant use have little outlet. There is some local production, but it is not of sufficient quality to compete seriously with the imports.

Italy is the chief supplier of fans to Argentina, but Great Britain, the United States and Germany are also prominent. There is a good demand in view of the hot summers, and all types and sizes are imported. The most popular are those of 10 or 12-in. diameter. Imported fans are mostly oscillating, and of the ordinary type painted black; but there is also a certain demand for the more modern designs in various colours. There is no local production. The sale of fans is seasonal in preparation for the hot weather, which runs from November to the end of March.

Although washing machines are subject to only a 10 per cent. duty, and in spite of the fact that there is no local industry, imports are relatively small. The large companies carry a small stock of washing machines, but efforts to introduce them have not met with much success. As it is customary for servants to do most of the washing, and as domestic labour is cheap, there is little inducement to invest in a comparatively expensive machine. A few machines of American make are sold each year, and there is also a cheap German product on the market, but only foreign firms with offices in Buenos Aires have thought it worth while to introduce this line.

Formerly there were considerable exports of electric lighting

fittings from Germany and other Continental sources, but this trade has been diminished by the production in Argentina of all types of fittings by many small factories and workshops. Local articles are sold at such low prices that it is almost impossible for foreign factories to compete. Fittings most in demand are of modern design; many are directly copied from samples originally imported, and it has been found that in some cases the retail price of such reproductions is equal to the Customs duties levied on the original imported article.

There is a small importation of a wide variety of other electrical appliances such as hair curlers, hair dryers, kettles, coffee percolators, waffle irons, hot pads, and kitchen mixers, but generally speaking the sales of these are somewhat restricted. The custom of drinking very strong coffee does away with the appeal of the percolator, and electric mixers are considered to be too expensive to put into the hands of ordinary servants. There is a certain demand for electric heaters, but these are mostly produced locally, and, with the increasing use of efficient central heating, the demand is rapidly decreasing. Most imports are of the grate rather than the reflector type, while the latter are produced cheaply by local makers. Electric water heaters are also supplied by Argentine manufacturers.

British Overseas Electrical Trade

BOTH imports and exports of electrical equipment were well above the average during September, the percentage increases over the values for the corresponding month of last year, which contained the same number of working days (twenty-five), being 9 and 30 per cent. respectively.

Exports amounted in value to £1,204,032, and it is necessary to go back to January, 1931, to find the equal of this sum. Compared with the preceding month (twenty-six working days) the increase was £195,203, and, as will be seen by the accompanying figures taken from the Board of Trade returns, the September, 1934, total was exceeded by £279,134, which itself was £150,483 more than in the corresponding month of 1933.

Analysis shows the position to be less favourable than at first sight, for there was a falling-off in eight of the classifications. Heavy shipments of telegraph and telephone cables (£103,829) chiefly account for the larger total, and turning to the table showing the destinations of exports it is noticed that goods and apparatus sent to Australia reached the remarkably high value of £231,485—more than double the amount for September, 1934. Considering these two facts in conjunction we assume that the recent large shipment of telephone cable from the Woolwich works of Siemens Brothers & Co., Ltd., for laying between Australia and Tasmania is responsible, although it is possible that this may be included in the October returns.

Apart from submarine cables there were also substantial exports of other types (£203,487), while shipments of telegraph and telephone apparatus (other than radio) were again high.

The principal destinations of the more important items in the goods and apparatus section were as follows, the September, 1934, figures being in parentheses:—

Rubber-insulated wires and cables.—Australia, £25,302 (£22,670); South Africa, £18,839 (£17,632); British India, £16,877 (£10,736); New Zealand, £7,111 (£2,903); other British countries, £12,474 (£11,579); foreign countries, £7,636 (£6,365).

Electric wires and cables (insulation other than rubber).—South Africa, £21,200 (£16,904); British India, £20,504 (£10,663); Australia, £14,272 (£18,001); other British countries, £14,201 (£9,195); foreign countries, £14,199 (£8,919).

Telegraph and telephone apparatus (other than radio).—Australia, £46,927 (£21,141); South Africa, £43,705 (£10,114); Argentina, £10,610 (£4,490); Canada, £949 (£906); other foreign countries, £53,696 (£35,993); other British countries, £12,662 (£13,129).

At £315,535 imports were higher than in any other month this year except August, and were £27,234 more than in September, 1934. Radio apparatus (+£16,964) and vacuum cleaners (+£14,234) largely influence the position, but there were increases in most categories.

The following analysis shows the sources of electrical imports into this country:—

Electrical goods and apparatus.—United States, £80,646 (£42,111); Germany, £56,230 (£55,424); Netherlands, £44,103 (£57,719); Switzerland, £16,927 (£16,997); France, £12,102 (£17,144); Austria, £10,147 (£7,552); Belgium, £9,329 (£9,209); other foreign countries, £28,863 (£20,945); British countries, £9,081 (£13,324).

EXPORTS AND IMPORTS DURING SEPTEMBER

	Exports. Sept., 1935.	Exports. Inc. or dec. compared with Sept., 1934.	Imports. Sept., 1935.	Imports. Inc. or dec. compared with Sept., 1934.
Submarine telegraph and telephone cables	£103,829	+ £95,928	*	—
Telegraph and telephone wires and cables (not submarine)	30,872	+ 8,955	*	—
Other insulated wires and cables	172,615	+ 37,048	£20,281	− £2,591
Radio receivers (not radiograms), excluding valves	26,197	+ 3,261	21,914	− 10,490
Radio transmitters (excluding valves)	10,975	− 19,033	*	—
Radio valves	40,445	+ 1,866	20,115	− 2,000
Other radio parts and accessories	53,549	+ 15,480	62,836	+ 4,494
Telegraph and telephone apparatus (other than radio)	168,549	+ 82,776	*	—
Electric carbons	*	—	5,325	− 7,963
Incandescent lamps	34,475	− 8,105	13,542	− 5,471
Other lighting apparatus	37,679	− 1,668	38,474	− 8,761
Primary batteries	18,207	+ 281	660	− 459
Accumulators	41,785	− 10,534	*	—
House service meters	8,753	− 2,067	*	—
Other electrical instruments	13,635	− 2,578	21,472	+ 1,584
Unenumerated electrical goods and apparatus	129,311	+ 7,488	62,809	− 884
Electric generators up to 200 kW	19,979	+ 4,189	*	—
Electric generators over 200 kW	33,070	− 2,062	*	—
Electric motors	84,426	+ 19,910	18,786†	+ 7,555
Convertors and transformers	37,730	− 25	*	—
Starting and controlling gear for motors	44,088	+ 24,542	*	—
Switchgear	82,972	+ 23,255	*	—
Other electric machinery	10,891	+ 227	7,656	− 22,307
Electrical vacuum cleaners	*	—	21,665	+ 14,983
Total	£1,204,032	+ £279,134	£315,535	+ £27,234

* Not classified separately. † Not railway and tramway motors.

Electric vacuum cleaners.—Canada, £12,591 (£1,982); United States, £4,742 (£514); Sweden, £761 (£1,367); Germany, £638 (£1,170); other foreign countries, £2,933 (£1,649).

In the first nine months of this year our exports of electrical equipment have amounted to £9,692,632, compared with £7,853,761, representing an increase of £1,838,871, or 23 per cent. Imports have amounted to £2,544,324, compared with £2,554,820, a decrease of £10,496.

BRITISH ELECTRICAL EXPORTS DURING SEPTEMBER

Destination.	Goods and apparatus, Sept., 1935.	Inc. or dec. compared with Sept., 1934.	Electric generators, Sept., 1935.	Inc. or dec. compared with Sept., 1934.	Motors, Sept., 1935.	Inc. or dec. compared with Sept., 1934.	Other electrical machinery, Sept., 1935.	Inc. or dec. compared with Sept., 1934.
Irish Free State	£46,623	+ £703	*	—	*	—	*	—
Union of South Africa	139,382	+ 40,753	£25,469	+ £6,913	£25,769	+ £16,296	£72,560	+ £31,370
British India	91,716	+ 15,279	2,857	+ 209	15,270	+ 3,046	25,111	− 4,079
British Malaya	9,196	− 4,926	*	—	*	—	2,956	− 963
Ceylon	5,655	− 1,023	*	—	*	—	*	—
Hong Kong	5,265	− 16,027	*	—	*	—	*	—
Australia	231,485	+ 130,618	12,155	+ 8,310	8,687	+ 5,800	15,185	+ 5,900
New Zealand	37,274	+ 5,775	*	—	5,393	+ 2,946	7,367	+ 3,018
Canada	10,215	+ 3,735	1,886	+ 1,416	2,978	− 633	1,412	− 495
Other British Countries	72,450	+ 22,362	5,260	− 5,471	11,106	+ 546	18,731	+ 7,755
Sweden	24,206	+ 4,372	*	—	*	—	*	—
Denmark	7,371	− 6,700	*	—	*	—	*	—
Belgium	15,440	+ 5,142	*	—	*	—	*	—
France	18,371	+ 4,704	*	—	*	—	2,384	+ 166
Spain	5,395	+ 1,094	*	—	*	—	*	—
Italy	4,952	+ 2,066	*	—	*	—	*	—
Greece	3,662	+ 1,384	*	—	*	—	*	—
Egypt	6,579	− 687	*	—	*	—	385	− 1,666
China	4,499	− 7,596	*	—	*	—	6,223	− 463
United States	2,860	− 7,459	*	—	*	—	*	—
Argentina	23,470	+ 5,836	*	—	942	+ 32	2,222	+ 732
Soviet Union	*	—	—	− 961	—	− 18	—	− 415
Netherlands	*	—	—	− 286	*	—	1,159	+ 67
Other Foreign Countries	124,810	+ 9,693	5,422	− 8,003	14,281	− 8,105	19,986	+ 5,072
Total	£890,876	+ £209,098	£53,049	+ £2,127	£84,426	+ £19,910	£175,681	+ £17,999

* Not classified separately.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

British Plant for New Zealand

Contracts totalling nearly £1,000,000 have been placed within the past few weeks with United Kingdom firms on behalf of New Zealand governmental and shipping interests. Other big shipping orders are impending. For the twelve months ended June 30th last New Zealand easily outstripped all other countries, per head of population, as a buyer of British goods. Details of the orders are as follows:—The New Zealand Government has ordered twenty-one transformers from the General Electric Co., Ltd., for service on the Waitaki and Mangahao power schemes, seven Diesel rail-cars from Leyland Motors, Ltd., the first of a series of similar railway contracts from the Dominion; and 2,000 telephones and other telephonic material from various British firms valued at £7,520. The Wellington City Corporation has placed a contract for turbine plant with Messrs. C. A. Parsons & Co., Ltd., the value of which is £40,000, and an order of the same value for boiler plant has been placed with Richardsons Westgarth-Brown Boveri, Ltd.

The Torquay Showrooms

In our last issue we described the new showrooms of the Torquay Corporation Electricity Department. These were formally inaugurated on October 9th, by Sir John R. Brooke (vice-chairman of the Electricity Commission), supported by Mr. R. H. Fox (secretary to the Central Electricity Board). In performing the opening ceremony Sir John Brooke made reference to the increases in kWh sold and the number of consumers and the reduction of prices, stating that these showed good arrangement and foresight in the policy of the Electricity Committee, who, with Mr. G. J. Hollyer, the borough electrical engineer, were to be congratulated. The Electricity Commissioners were gratified that the undertaking was going out into the countryside. It had been able to do that without detriment either to its own prices or supplies. Although the Electricity Department had been supplying that countryside area for only about four years, it was paying its way, and in a few years' time would be making a substantial contribution to the success of the undertaking. He understood that of the domestic premises in the town only about 43 per cent. was connected to the Corporation's supply, whereas the proportion was 70 or 80 per cent. or even more in comparable districts. He suggested that they should assist owners and occupiers to get their houses wired, a policy which he believed over 60 per cent. of the country's undertakings had adopted.

South Australia Centenary

The Empire Exhibition which is to be held in Adelaide from March 20th to May 16th, 1936, is the opening function of the South Australian Centenary Celebrations. Applications received up to September 20th prove the popularity of the exhibition and entries are in the nature of a record. With several months to go before the opening date it is expected that in order to cope with the entries likely to be received it will be necessary to erect further buildings.

The E.L.M.A. Touring Demonstration Van

The E.L.M.A. (Lighting Service Bureau) touring demonstration van commenced a tour of Scotland at the beginning of the current month which will extend to December 20th. The supply authorities which have already been visited are Hamilton Burgh Electricity Department and the Clyde Valley Electric Power Co. During the remainder of the tour the following authorities will be visited: The Electricity Departments of the Motherwell and Greenock Corporations, Dumfries County Council Electricity Department, North Berwick Electricity Department, Scottish Southern Electric Supply Co., Lothians Electric Power Co., and the Fifeshire Electric Power Co.

The new type of cable truck of the Manchester Electricity Department

The Cheltenham Electrical Exhibition

An electrical exhibition organised by the Cheltenham Corporation Electricity Department, under the supervision of Mr. W. J. Bache, the borough electrical engineer, was opened on Monday last at the Town Hall, by the Mayoress, Mrs. E. J. Ward. On the ground floor and galleries of the large central hall, there is a varied display of domestic electrical appliances

A general view of the Cheltenham electrical exhibition

in which many leading manufacturers are represented, while local electrical firms are also exhibiting. The refreshment room has been equipped as an all-electric restaurant, while in the supper room a four-roomed bungalow has been erected so that visitors can see the electrical appliances in their normal surroundings. The main feature of interest is the all-electric kitchen. Adjoining the bungalow a theatre has been built in which lectures and demonstrations are being given daily, and in the winter garden entertainments are being given including dances, variety items and fashion parades, to demonstrate the advantages of colour-light changing for shop-window lighting and home decoration. The Electricity Department has obtained the collaboration of E.D.A. in preparing the exhibition.

New Type of Cable Truck

Manchester Corporation Electricity Department has just put into service a new type of cable-carrying vehicle intended for service in the transport of drums of cable and transformers between the city electrical stores and the site of jobs. Hitherto, electric vehicles have been engaged on this work. The tractor is a standard model Karrier with a detachable trailer fitted with a patent pick-up and self-locking device. The vehicle and its equipment were supplied by Lookers, Ltd., of Manchester, to the specification of the Electricity Department. The main particulars of this outfit are:—Length overall, 31 ft. 4 in.; internal length of cable trailer, 14 ft. 5 in.; width, 6 ft. 9 in.; sideboards, 3 ft. 2 in. high; loading height, 2 ft. The tailboard forms a ramp for the loading of cable drums and transformers. The trailer is capable of carrying a net load of ten tons. A servo-operated winch is provided to assist in loading and unloading operations, but in an emergency this can be hand-operated. The front wheels of the trailer can be lowered to the ground by means of a hand wheel. Spare wheels are carried on the fore part of the trailer. An idea of the general lay-out of the truck can be obtained from the accompanying illustration.

The Austrian Cable Industry

Austrian export trade in lead-covered cable and other insulated wire and cable continues to decline. One reason is that prices are too high, a condition which is ascribed partly to the high Austrian import duty on lead. Another

reason is the establishment of manufacture in former markets, for example, Jugoslavia and Rumania. For this falling-off in their foreign business the Austrian makers have, however, been compensated to a large extent by a steady increase in home demand, due to the extension of long-distance transmission, the conversion of the railways to electric traction, the expansion of the telephone system, and the improvement in the lighting wiring business. As a result the four works which manufacture lead-covered cable and the nine factories turning out other kinds of electric cable and wire have recently been occupied to the extent of about 35 per cent. of their total capacity—a marked advance on the preceding two years.

Ironmongers as Electrical Traders

We have recently recorded a number of activities upon which the newly formed Electrical Section of the Ironmongers' Federated Association is engaged. These include negotiations for representation with the National Electrical Contractors' Trading Association and the Electrical Fair Trading Council, and the institution of a hire-purchase scheme for the sale of electrical appliances. Mr. E. B. Holloway, the hon. secretary of the Section, has now sent us a print of the device which has been prepared for the use of members of the Section. This is reproduced herewith (actual size).

Irish Free State Electrical Imports

There was a slightly quieter tone in the electrical trade in the Irish Free State during August last, the imports of electrical machinery and cognate material attaining a value during the month of £94,563, as compared with £111,405 in August, 1934. The appended table shows the imports during the first eight months of the current and past years:—

	January–August. 1934.	1935.
	£	£
Electric motors	31,422	32,560
Other electrical machinery	164,186	136,643
Dry batteries and parts	13,827	18,139
Electric lamp bulbs	40,810	45,280
Electric lighting accessories, fittings and parts	29,883	54,949
Electric wires and cables, insulated	61,130	68,431
Telegraph and telephone apparatus	7,920	4,113
Radio receivers, complete	37,132	51,889
Radio-gramophones, complete	2,152	2,440
Other radio apparatus, fully or partly assembled	4,292	3,722
Radio parts and accessories	40,397	44,192
Other electrical goods and apparatus	126,271	166,218
Totals	£559,422	£628,585

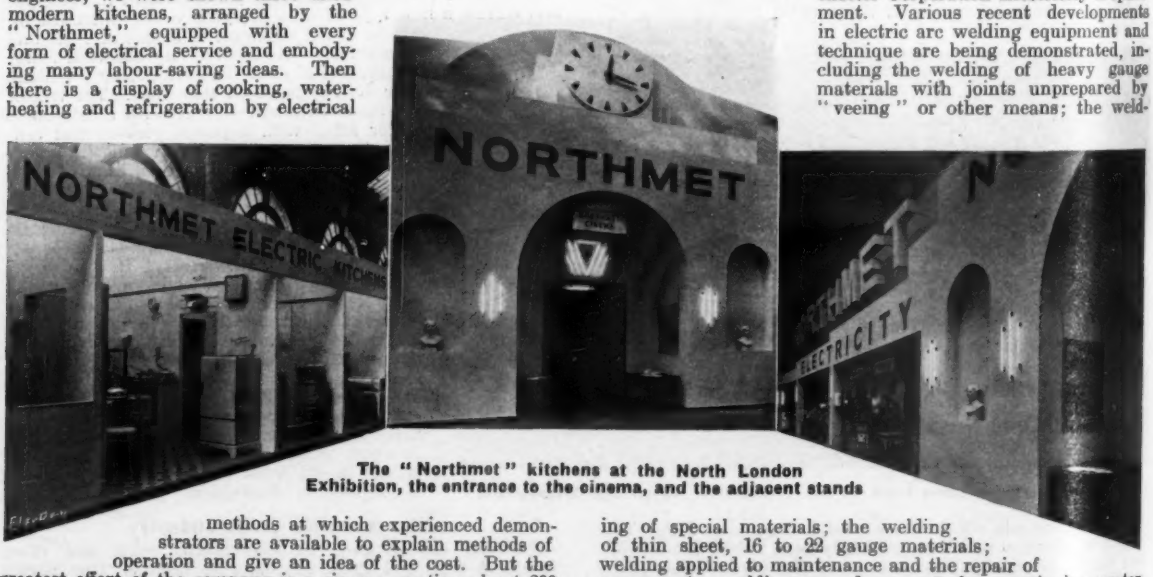
As will be seen, all but three of the items of the table show an increase which, for the eight months, amounts in the aggregate to £69,163.

Approved Electrodes

Philips Industrial informs us that its electrodes have been approved by Lloyd's Register of Shipping, the British Corporation Register of Shipping and Aircraft, and the Board of Trade.

The Northmet in North London

A prominent part is played by the North Metropolitan Electric Power Supply Co. in the North London Exhibition now running at the Alexandra Palace. During a tour this week, chaperoned by Mr. E. Boys, the secretary of the company, and Capt. J. M. Donaldson, the chief engineer, we were shown three ultra-modern kitchens, arranged by the "Northmet," equipped with every form of electrical service and embodying many labour-saving ideas. Then there is a display of cooking, water-heating and refrigeration by electrical methods at which experienced demonstrators are available to explain methods of operation and give an idea of the cost. But the greatest effort of the company is a cinema, seating about 200 people, for the exhibition of the E.D.A. films and one of general interest specially booked by the company, "Thy Friend the Dog." The stand and cinema were both designed by the company's staff. By arrangement with the organisers of the exhibition the company printed 100,000 special admission tickets at its offices and the bulk of these have been sent to consumers together with tickets for the film show. The exhibition remains open until October 26th and it should produce a fair reward for the company's enterprise in the shape of new consumers and additional load.



The "Northmet" kitchens at the North London Exhibition, the entrance to the cinema, and the adjacent stands

Another electrical concern which has a good display is the British Vacuum Cleaner & Engineering Co., Ltd., whose "Goblin" cleaners are being demonstrated. In addition to this the company is running a "Goblin" cabaret which twenty-four appropriately garbed juveniles are presenting.

The Welbeck Company is also exhibiting its vacuum cleaners.

A "Clesco" Exhibit at Camberwell

An exhibit arranged by the County of London Electric Supply Co., Ltd., depicting the progress of electricity in the home, street and factory is a prominent feature of the Camberwell Borough Council's Local Government Centenary Exhibition which was opened at the South London Art Gallery, Peckham Road, on Tuesday. Among many items of historical interest displayed are specimens of early incandescent lamps, main fuses and meters, while modern products include sections of all types of cables, "Osira" electric-discharge lamps, street lanterns and models of transmission line towers as well as examples of domestic appliances. Charts are displayed showing the advance in the efficiency of electric lamps and of the consumption of electricity in Camberwell, where sales rose from 4,366,860 kWh in 1920 to 23,406,003 kWh in 1934. There is also an interesting collection of photographs of generating and distributing plant and street lighting. The exhibition will remain open until November 9th.

Winding-up Petitions

In the Chancery Division on October 14th Mr. Justice Bennett had before him a petition for the compulsory winding-up of J. Briggs Electrical Contractors, Ltd. By consent the petition was dismissed.

On the same day Mr. Justice Bennett heard a petition for the compulsory winding-up of Miller & Co. (Radio), Ltd., by a creditor for £264. The company did not appear and his Lordship made the usual compulsory order.

Another petition was for the compulsory winding-up of Edison Bell (International), Ltd. This was a judgment creditor's petition. On behalf of the company it was stated that it was negotiating with a view to disposing of certain of its interests in Italy and another foreign country. The company therefore asked for an adjournment. The company opposed the petition and creditors for £1,700 supported it. His Lordship ordered the petition to stand over for a week.

Buenos Aires Commercial Secretary's Visit

Mr. E. R. Lingeman, Commercial Secretary at Buenos Aires, is at present in this country on an official visit, and will be available at the Department of Overseas Trade on October 28th and 29th for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to the Argentine Republic. At a later date he will visit a number of industrial centres in the provinces. Firms desiring an interview with Mr. Lingeman in London or information regarding the provincial centres he will visit should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 14148/35.

A Welding Exhibition at Manchester

By arrangement with the English Electric Co., Ltd., Stafford, a welding exhibition was opened on Wednesday last in the demonstration workshop of the Manchester Corporation Electricity Department. Various recent developments in electric arc welding equipment and technique are being demonstrated, including the welding of heavy gauge materials with joints unprepared by "veeing" or other means; the welding of special materials; the welding of thin sheet, 16 to 22 gauge materials; welding applied to maintenance and the repair of worn parts; welding procedure control; a.c. single-operator portable and multi-operator equipments; a.c./d.c. welding equipments; and samples of typical welding joints. During

the run of the exhibition, which closes on October 24th, lectures on welding are being given.

Social Events

About 450 people were present at the annual staff dinner of W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre & Rubber Co., Ltd., on Saturday last at Harrod's Georgian Restaurant. Mr. R. O. Wright, M.I.E.E., A.M.I.Mech.E., manager, Gravesend Works, was in the chair, and the speeches were few and brief. Mr. F. J. Bettley proposed the toast of the Cable Company and Mr. S. J. Madden that of the Tyre Company, the chairman responding to both toasts in one speech. Mr. Bettley claimed that the Cable Co.'s business had been built up by giving the best goods and fair dealing, and he was sure that that reputation would be fully maintained by the present management. He reminded his listeners that the directors had the difficult task of holding the balance equally between the shareholders and the staff. There were few large concerns that retained the personal touch between management and employés that existed in Henley's. Mr. Madden referred to the considerable improvement which was taking place in the Tyre Company's business. In his reply, Mr. Wright said that this year's output and efficiency had surpassed last year's level. The Engineering Department especially was going ahead by leaps and bounds. In proposing the chairman's health, Sir Montague Hughman (chairman of Henley's) said that Mr. Wright was shortly celebrating the completion of thirty-nine years with the company. Mr. Wright briefly acknowledged the toast, and foreshadowed his retirement in a year's time. After dinner the room was cleared for dancing and there was an excellent cabaret show.

The London Section of the Plastic Mouldings Golfing Society is holding a dinner, dance and cabaret at Grosvenor House, Park Lane, W.1, on November 1st. Tickets (£1 1s. each) are obtainable from Mr. C. C. Last, Windsor House, Victoria Street, S.W.1.

Aluminium Facts and Figures

The British Aluminium Co., Ltd., has issued a handy booklet entitled "Aluminium Facts and Figures." This contains a fund of information on aluminium and aluminium alloys and their many uses, including notes on melting, casting, annealing, heat-treatment of alloys, electric welding, soldering, riveting, &c. The ordinary edition has a strong cardboard binding, and there is also an edition available on India paper for the pocket.

A Lighting and Installation Convention

During all last week an exhibition of modern industrial and commercial lighting equipment, including also the latest developments in conduit wiring, switchgear and installation practice generally, was staged in Coventry by the Simplex Electric Co., Ltd., at the showrooms of the Coventry Corporation Electricity Department. Councillor W. H. Malcolm (chairman of the Corporation Electricity Committee) who opened the exhibition, said its idea was to further the use of electricity in industry and other directions, such as street lighting. It was noteworthy that a large portion of the exhibition was taken up by the section devoted to the elimination of all danger in electrical appliances. Mr. John Huntington (joint general manager of Simplex Electric Co., Ltd.) said that the company endeavoured to develop to the highest degree the quality of making all appliances foolproof. During the last year they had had help from the Home Office on one side and the Mines Department on the other in their plans for the development of a complete range of flameproof apparatus. Among the most interesting exhibits were the flameproof fittings referred to by Mr. Huntington. These comprise a range of lanterns, connection boxes, &c., for use with armoured cables, chiefly for underground colliery work, and a companion range designed for conduit wiring, especially suitable for use in factories. A great variety of industrial reflector fittings for all kinds of general and local lighting, combining safety with efficiency, was also on view. In the switchgear section was shown virtually everything for the control and protection of low and medium pressure installations, including ironclad switches, switch-fuses, cutouts, distribution boards, several types of cooker control switch and typical examples of the Simplex system of switch panel construction. Every phase of the company's steel conduit system was shown, together with new safety types of switch-plugs, water-tight fittings, &c. Practical demonstrations were given from time to time during the week, and a special two-day illumination design course, for the benefit of technical students, apprentices and others, was held on Tuesday and Wednesday. Visits were paid by the Coventry Engineering Society and students of the local technical school on Tuesday, and by the Coventry Chamber of Commerce on Thursday.

Registered Electrical Contractors

At its last meeting the Executive Committee of the National Register of Electrical Installation Contractors accepted applications from the following for registration:—

Maitland & Co. (Manchester), Ltd., Manchester.
Williams, J. R., Levenshulme, Manchester.
Carter, W. G., Wallasey.
Electro Switch Co., Stockport.
Mullin, W., Ltd., Douglas, I.O.M.
Hogarth, W., Burrowgate, Penrith, Cumberland.
F. & D. Robinson (Warlingham), Ltd., Warlingham.
Townsend & Sutcliffe, Halifax.
McGregor, W. D., Wallasey.
Ewell Court Electrical, Ltd., Ewell.
Phœnix Electrical Co. (London), Ltd., London, S.W.1.
Scottish Western Electrical Contractors, Ltd., Greenock.
Star Electrical Co., Ltd., 357, Edgware Road, W.2.
Gordon & Moodycliffe, Dumfries.
Trojan (Radiolectric), Ltd., Manchester.
Marshall, J. D., Dumfries.
Richmond, Clement, Halifax.
Hunter, F. R., Liverpool, 1.
Mitchell Graham & Son, Ltd., Edinburgh.
Osborne & Hunter, Ltd., Glasgow.

At the same meeting six applications were withdrawn and fourteen were declined.

Commercial Electrical Travellers

The annual dinner and dance of the Electrical Trades' Commercial Travellers' Association will be held on November 15th at the Criterion Restaurant, Piccadilly Circus, W.1.

The Met-Vick Trafford Park Works

The illustration which appears on p. 533 is reproduced from an aerial photograph of the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd. As some measure of the size of the works it may be noted that the total ground area is 130 acres; the frontage occupied by buildings is 1,800 ft.; the distance through the works from the north gate (seen near the left-hand side of the picture) to the south gate by the water tower is 2,040 ft., and the height of the water tower is 209 ft. The first two buildings on the left of the illustration are the foundries, while the next building contains the forge and the transformer department. Beyond the foundries, to the right, is a long three-storey building, shown with four long skylights, which is the meter and instrument department, and beyond the transformer department is a long building, in two sections, devoted entirely to the production of welded-steel parts. Behind the front six-storey block of main offices are the two 900-ft. long main mechanical and electrical machine aisles and galleries, and beyond these, in the vicinity of the water tower, is a group of buildings containing the various sections of the research department. To the right of the main aisles are the warehouse and canteens, and to the right of these is a new shop, termed the west works, erected about seven years ago to relieve congestion in the main shops, and

Mr. J. Huntington (joint general manager of the Simplex Electric Co.) giving a talk on modern wiring practice at the Coventry Electricity Department's showroom, and the company's display in one of the show-windows

now devoted entirely to the manufacture of high-voltage and metal-clad switchgear.

Orders Recently Booked

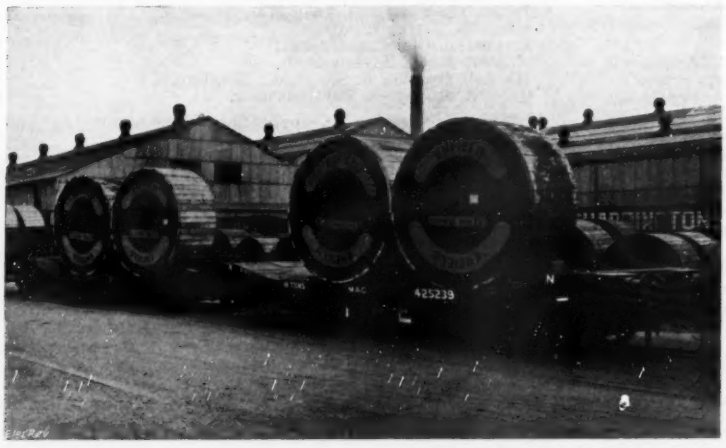
Philips Industrial (Philips Lamps, Ltd.) has recently installed amplifying equipment at the Uxbridge Swimming Pool. The installation includes a high-fidelity microphone and floor stand, a turntable cabinet, two permanent-magnet moving-coil loud speakers, each capable of handling without stress an undistorted output of 10 W and encased in weather-proof cases with directional flares, and one permanent-magnet moving-coil loud speaker handling 6 W. The speakers are employed for sound distribution over the open-air swimming pool, and the gramophone amplifier is used for broadcasting music, &c., in the café.

Messrs. Davey, Paxman & Co. (Colchester), Ltd., have received an order from the Army & Navy Co-operative Society, Ltd., for one of their latest "Vee" type Paxman-Ricardo high-speed Diesel engines. The engine has twelve cylinders, capable of developing 350 b.h.p. at 1,000 r.p.m. It will be direct coupled to a 230-kW Crompton Parkinson d.c. generator. This installation will bring the Paxman Diesel generating sets in use by the Army & Navy Stores up to approximately 3,000 h.p.

Among the sales of International Combustion, Ltd., during the past month were two tri-drum boilers for the Kirkstall power station of Leeds Corporation, six feeders for Fulham generating station, and ash handling modifications for Pinkston (Glasgow).

Swedish Industry and Trade

The *Swedish Economic Review* reports an improvement in Swedish industry during the second quarter of the current year. There was a shortage of skilled workers in the electro-mechanical branch "where the possibilities of employment increased considerably during the quarter." The exports of electrical machines during the first seven months of this year were valued at 13,536,000 kr. as compared with 12,194,000 kr. in the corresponding period of last year. Exports of telephone and telegraph apparatus during the same period rose in value from 2,357,000 kr. to 2,691,000 kr.



33-kV cable leaving the factory of the Enfield Cable Works, Ltd., Brimsdown, en route for New Zealand

Norwegian Electrical Imports

A comparison between Norwegian imports of electrical machinery and appliances during the first eight months of 1935 and 1934 shows a substantial increase over the whole range. The total import value this year amounts to £683,100 against £559,050 last year, an increase of 22 per cent. The following tables show the variations in some principal groups:—

	1934.	1935.	Increase %
Motors	£67,900	£67,650	—
Dynamos and alternators	£9,000	£15,500	72
Transformers	£9,300	£10,150	9
Large switches	£17,750	£23,150	30
Broadcast receivers and compnts.	£79,250	£83,650	5½
	Tons.	Tons.	
Dry batteries	182	201	10
Accumulators	276	346	25
Cables and conductor-wire	910	1,444	59

Aluminium Production in Russia

According to the *Bulletin* of the Russo-British Chamber of Commerce, the Dnieper Aluminium Combine, which is the largest single consumer of power produced by the Dnieper hydro-electric undertaking, is being further extended. Its huge shops are being equipped but it is still far short of reaching its scheduled annual output of 40,000 tons, the 1935 output being estimated at about 18,000 tons. Electric furnaces of the Miguet type are being employed.

Electric Cooking at a Manchester School

The September "Power Service Bulletin" of the Manchester Corporation Electricity Department says that for four years the Manchester Grammar School has been cooking electrically, from 500 to 600 two-course dinners being cooked daily. About 70 kW of apparatus is connected and the repair bill has amounted only to 25s.

For Sale

Messrs. Knight, Frank & Rutley will sell by auction at Palmers Works, Jarrow-on-Tyne, on November 5th and following days, the contents, including the electrical equipment, of the s.s. *Olympic*.

Dorchester Electricity Department has for sale plant consequent upon the closing down of its power station.

(See our classified advertisements.)

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, October 16th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £20 15s., 5s. dec. Spelter, £16 6s. 3d., 8s. 3d. dec. English block tin, £242, £13 15s. inc.

Messrs. Frederick Smith & Co., report, October 16th: No change in the price of electrolytic copper bars, wire rods and h.c. wire and silicium bronze wire.

Messrs. Edward Till & Co., report, October 16th: India rubber, Para fine, 5½d., ½d. inc.

Plant Inspection

The Technical Report for 1933-34 of the British Engine, Boiler and Electrical Insurance Co., Ltd. (7s. 6d.) describes a number of failures of plant that have come under the company's observation together with 160 photographs and diagrams relating to engineering details. The Report records the results of further researches into the relationship of a bend to a tensile test, first dealt with in the 1932 volume, and also of an investigation into the methods usually applied in making bending tests, a subject that is receiving the attention of the B.S.I., especially in connection with welding material.

33-kV Cable for New Zealand

The Enfield Cable Works, Ltd., have just dispatched on board the s.s. *Rangitiki* what are claimed to be the first 33-kV cables for use in New Zealand. They are required by the New Zealand Government Railways to be laid in close proximity to the railway line over a portion of the section between Pukerua Bay and Paekakariki, partly in tunnels and partly in the open. The shipment comprises 1,349 yds. (in four lengths), of 0.06 sq. in. 3-core circular conductors, paper-insulated, ternary lead alloy sheathed cable, "H.S.L." type (three separately metal sheathed cores with metallised paper between the insulation and the metal sheath). This being the first shipment of its kind to New Zealand, the makers of the cable were requested to send out one of their jointers who has been engaged by the Electrical Department of the New Zealand Government Railways not only to carry out the jointing of this cable, but to train the railway's own jointers.

Trade Announcements

Mr. Alan Wright has undertaken the sales representation for the "Wylex" productions of Messrs. George H. Scholes and Co., Ltd., in London and the Home Counties, South Midlands and East Anglia, and has opened an office at Grand Buildings, Trafalgar Square, W.C., to deal with this business.

The Weinbau Incandescent & Electrical Co., Ltd., has acquired a new branch depôt at 28, Victoria Street, S.W.1, with a trade counter in Broadway Court, Broadway, S.W.1. This branch will be under the management of Mr. F. L. Robbins.

Mr. G. H. Emons, 19, Alexandra Road, Hornsey, N.8, has been appointed sole representative for the Star Electro Carbons, 218, Old Street, E.C., for the London electrical and motor accessory trade.

The Sloan Electrical Co., Ltd., asks us to state that its address is now "Slonetric House," 54-55, Fetter Lane, E.C., and not Golden Lane as stated in our last issue.

The Universal Lamp Co., Ltd., has taken additional premises at 89, Great Eastern Street, E.C., which will be used as showrooms for lamp shades, standards, &c.

New Catalogues and Lists

Crofts (Engineers), Ltd., Thornbury, Bradford.—A comprehensive illustrated catalogue of variable speed gears, including details of standard design machines.

Expanded Metal Co., Ltd., Stranton Works, West Hartlepool.—A booklet on "Girdohmet" and "Stripmet" expanded metal resistances.

G. A. Harvey & Co. (London), Ltd., Greenwich Metal Works, S.E.7.—A list of mild steel gilled tubes.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—New pamphlets relating to "Rey-O" cable-racks and heavy-duty rewirable cartridge fuses.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—A new and enlarged edition of a catalogue on cable jointing and installation equipment.

British Insulated Cables, Ltd., Prescot, Lancs.—A new catalogue dealing with service cut-outs with non-conductive cases.

B.E.N. Patents, Ltd., Gorst Road, Park Royal, N.W.10.—A catalogue of spraying equipment.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. A new automobile bulb folder and a leaflet on enamelled steel storage cabinets for these lamps.

Philips Industrial, 145, Charing Cross Road, W.C.2.—Leaflets on a new home battery charger and a range of extension loud speakers.

National Fire Protection Co., Ltd., Petersham Road, Richmond.—A complete illustrated catalogue of fire equipment.

Lighting Trades, Ltd., 51, Garratt Lane, Wandsworth, S.W.18.—Complete catalogues of electric lighting shades, "Redot" electric fires, domestic appliances and accessories.

J. Moore & Co., Ravald Street Works, Salford, 3.—A catalogue of electrical accessories, fittings and domestic appliances.

M. & C. Switchgear, Ltd., Kelvinside Works, Kirkintilloch, Glasgow.—A pamphlet on an a.c. push-button starter for "Straight-on" starting.

Bankruptcy Proceedings

N. P. Clark, Hastingwood Place, Harlow, Essex, electrical dealer.—This receiving order was made on the debtor's petition, and the statement of affairs which has been filed shows liabilities of £360 with assets of £129, leaving a deficiency of £231. In January, 1934, with a capital of £20, debtor commenced business at Ilford under the style of the Eastern Electrical Supply Co. and became sole agent for Essex for a firm dealing in vacuum cleaners and washing and ironing machines, but the business was not successful. Debtor attributes his failure to irrecoverable commission paid on cancelled sales and heavy business expenses.

S. W. Godfrey, electrical and radio engineer, 44, Cromwell Road, Sprowston, Norfolk.—Public examination December 5th at the County Court House, Nottingham.

North End Radio, wireless factors, 250B, North End Road, Fulham, S.W.—Receiving order made October 9th on a creditor's petition.

G. S. Whiston, electrical engineer, 112, West Street, Crewe.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, released September 18th.

S. A. Sears, radio engineer, 98, High Street, Redbourn.—Trustee, Mr. J. S. B. Hole, 240, High Holborn, W.C., released August 27th.

Company Liquidations

Pemberton & Sturgess, Ltd.—Meeting, November 8th at Balfour House, Finsbury Pavement, London, E.C., to receive an account of the winding-up by the liquidator, Mr. W. A. J. Osborne.

Neglin Lamp Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. Boniface, 10, Serjeants' Inn, E.C.4. Particulars of claims to the liquidator by November 15th.

J. Briggs (Electrical Contractors), Ltd.—Winding-up voluntarily. Liquidator, Mr. F. T. Barnes, 37, Walbrook, E.C.

Private Arrangements

S. Dagnall, Ltd., 420, Stratford Road, Birmingham, electrical contractors.—A meeting of creditors was held recently when a statement of affairs was submitted which showed ranking liabilities of £5,172 and net assets of £4,701, leaving a deficiency, so far as the creditors were concerned, of £471. The issued capital of the company was £4,637, so that as regarded the shareholders there was a deficiency of £5,108. It was reported that the company was formed in 1920 with a nominal capital of £5,000 to purchase an existing business by the issue of fully paid shares. For the year to June 30th, 1931, the sales were £17,066, with a gross profit of £2,859, and a net profit of £394, but subsequently net losses were incurred. The company's position was attributed to excessive overhead expenses. The creditors decided that the shareholders should be requested to pass resolutions for voluntary liquidation and to nominate Mr. F. E. Bendall, of Messrs. Poppleton & Appleby, as liquidator, with a committee of inspection.

The Kingsbury Showrooms

WITH the exception of the Wood Green premises, Electricity House, Kingsbury, opened on Thursday last week by Mr. E. H. Everett, J.P., chairman of the Wembley Urban District Council, is the largest of the thirty-two electricity showrooms now owned by the North Metropolitan Electric Power Supply Co. On the ground floor is the main showroom for domestic appliances generally, at the rear being a kitchen where demonstrations will be given every Tuesday afternoon. Also on the ground floor is another large demonstration room containing facilities for displaying water-heating apparatus in operation.

A lecture theatre on the fourth and top floor, reached by a lift, is provided with a stage and equipment for showing films and lantern slides, while the effects of different lighting systems may be seen in model shop windows incorporated in the side walls. An excellent example of cornice lighting is the main source of illumination of this theatre, various types of wall brackets being used for decorative purposes. The remainder of the building is utilised as general offices and storerooms.

The heating of the main building, with the exception of the showroom and demonstration hall, is carried out by means of an electric thermal-storage hot-water system (Crittall), comprising standard type water-circulating radiators fixed round the walls, fed by a storage tank heated by two banks of immersion heaters, totalling 75 kW. The heaters are thermostatically controlled, both banks being in circuit from 10 p.m. to 7 a.m., the smaller bank (25 kW) coming into circuit again as a boost between 12 noon and 2 p.m. The demonstration hall is heated by Thermidair radiators in walnut-finished casings, while the showroom heating is carried out by the fires and radiators displayed there.

At the opening ceremony Lord Ashfield, chairman of the Northmet Co., commenting on the phenomenal growth of the company's undertaking, said that fifteen years ago there were only 22,000 consumers, 53 million kWh of electricity consumed a year, and 700 persons on the staff. To-day there were 300,000 consumers and 2,700 staff, and the 500 million kWh mark would probably be reached this year. The company now had an average annual expenditure of about £1,000,000, and in the last five years £100,000 had been spent in Kingsbury alone. The Northmet was wise in arranging each district to be provided with showrooms to act as a link with consumers. Captain J. M. Donaldson, the company's chief engineer, gave some interesting reminiscences of the early electricity supply arrangements in the district.

Three views of the new Northmet showrooms at Kingsbury (Left) the lecture theatre and (right) the main showroom and cashier's desk

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—ANNUAL REPORT.—That the year 1934-35 has been a memorable one in the activities of the undertaking is stated by Mr. J. A. Bell, the engineer and manager, in his annual report. To justify this he shows that the annual increase in output was the largest in the history of the undertaking; more consumers were connected than ever before; a record number of new assisted-wiring consumers was obtained; the number of consumers on domestic load was the largest yet recorded; and the year saw the maximum number of employés engaged in the works at one time. The amount of electricity sold for lighting was 14¼ per cent. higher on the flat or demand rates and 23 per cent. on the domestic rate. For power there was a slight decrease of 1.2 per cent., due largely to a paper works generating its own supply.

ADDITIONAL LOANS REQUIRED.—The Electricity Committee is applying to the Electricity Commissioners for additional borrowing powers to the extent of £110,000 for mains, services and sub-station equipment, the expenditure to be spread over three years. Mains extensions in various parts of the city and county, amounting to £4,214, have been recommended.

Accrington.—RURAL EXTENSIONS.—Several schemes have been approved by the Town Council for low-voltage electricity mains extensions. One takes in ten farms and eleven houses; another, four farms, five houses and a mill; and a third, eleven farms and thirty-three cottages.

TARIFF REDUCTIONS.—The following reduced rates have been approved: Lighting, first 3,000 kWh per quarter at 3¾d. per kWh, and over 3,000 at 3d.; heating and domestic purposes, 6d. per kWh.; rateable value basis, a fixed charge of 12½ per cent. per annum on the first £100 of r.v. and 5 per cent. above that amount, with a "unit" charge of ¼d.; power (quarterly accounts), 1d. per kWh (minimum charge of 7s. 6d. per quarter); power (monthly accounts), 0.65d. per kWh for the first 50,000 kWh per month and 0.53d. above that amount, subject to discount and fluctuations based on the cost of fuel; shop-window lighting after shop hours, ¼d. per kWh, plus 10s. per quarter for the rental of a time-switch and a special meter; and electric signs outside premises, ¼d. per kWh, the signs to be fixed so that they cannot be used for illuminating shop windows. A discount of 10 per cent. is allowed for prompt payment.

Bala.—ELECTRIFICATION SCHEME.—The North Wales Power Co. has now completed its scheme of electrification in Bala. The main transmission line has been tapped at Frongoch, about three miles out of the town, and on the Rhiwlas estate. From Frongoch the company has erected approximately three miles of overhead line, which terminates through a short underground cable section in a transformer sub-station erected near the Great Western Railway.

Bedford.—AERODROME SUPPLY.—The Electricity Committee is to provide a supply to the Cranfield aerodrome.

Bexley.—LOWER CHARGES.—The Urban District Council has reduced the "unit" charge on the "all-in" rate for domestic and business premises from ¾d. to ½d., and the power flat rate from 1½d. to 1d. per kWh.

Bradford.—SUB-STATION IMPROVEMENTS.—The Electricity Committee is to modernise the Rawson Road sub-station and provide additional cables at a cost of £2,572.

Bridge.—RURAL DEMAND FOR ELECTRICITY.—At a meeting of the Bridge-Blean Rural District Council protests were made at the delay of the South-Eastern Power Co. and the Kent Power Co. in supplying villages in the district with electricity. It was decided to communicate with the Electricity Commissioners, the Ministry of Transport, and the local Member of Parliament.

Clyde Valley Area.—FURTHER TARIFF REDUCTIONS.—A new scale of charges is announced by the Clyde Valley Electrical Power Co., Ltd., showing an approximate reduction of 8 per cent. on the existing tariffs, which were reduced last year by 10 per cent.

Crewe.—CONCESSION TO CONSUMERS.—The charge for electricity for lighting has been reduced from 4d. to 3¾d. per kWh, and the "unit" charge under the domestic all-in tariff from ¾d. to ½d.

Denshaw.—SUPPLY INAUGURATED.—An electricity supply, provided by the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, was inaugurated recently. The work has cost about £4,000, and for a period of not more than five years consumers will be required to pay an additional 12½ per cent. over the ordinary charge for electricity.

Derby.—ELECTRICAL PROGRESS.—In his annual report for the year ended March 31st Mr. F. Nicholls, the borough electrical engineer, states that the sales of electricity for domestic purposes increased by 20.4 per cent. over the previous year, while the average amount of electricity sold per head advanced from 278 to 305 kWh. The number of consumers increased by 3,524 (9.6 per cent.), bringing the total to 40,296. Mr. Nicholls points out that the reassessment of the undertaking resulted in an increase of £9,797 in the rates.

Douglas (I.O.M.).—REVISED CHARGES.—A reduction of tariffs is proposed by the Electricity Committee. The flat rate for lighting will be 6d. per kWh in the case of small consumers (5.7d. net), and for consumers using over 2,000 kWh per annum 6d. per kWh for the first 2,000 kWh per annum (5.7d. net), and 5¼d. per kWh for all in excess of 2,000 kWh (4.99d. net). Concessions are also made in the all-in tariff. The hire charges for water circulators and storage tanks will be: 1½-gall. storage tanks, 3s. 9d. per quarter; 2-kW circulator (switch to be provided by the consumer), 2s. 6d. per quarter; 2-kW circulator with thermostatic control, 3s. 9d. per quarter; 2-kW circulator with 3-heat control, pilot lamp and d.p. fuses, 3s. 9d. per quarter. The new scale benefits consumers by about £3,000 per year.

Eastbourne.—FRINGE ORDER.—The Electricity Commissioners have granted a Fringe Order for the Corporation to supply electricity to premises at Carter's Corner and Highlands Farm, Hailsham.

TARIFF FOR SHOW HOUSES.—A special tariff is to be introduced for show houses on housing estates. The standing charge will be at half the usual rate, and there will be a normal "unit" charge.

WATER HEATERS.—A scheme for the hire purchase of immersion heaters over a period of three years has been approved by the Electricity Committee. The rate for a 1-kW heater, with 40 ft. of wiring, and lagging, is 13s. per quarter. Larger sizes are included in the scheme.

LOANS.—Sanction has been received from the Electricity Commissioners to the Corporation borrowing £4,560 for electrical work in connection with Cherry Garden estate, £601 for Dukelands estate, and £3,221 for Ratton estate.

OVERHEAD LINES.—The Minister of Transport has sanctioned the erection of overhead lines at Jenkins Green and Saltmarsh.

Eccles.—UTENSILS ON HIRE.—A set of suitable pans (3, 5 and 7 pint) is being offered at a rental of 4s. a year for use with cookers hired from the Electricity Department.

Edzell (Angus).—ELECTRICITY SCHEME.—The ratepayers having voted in favour of an electricity scheme for the village, the Grampian Electricity Supply Co. has offered to provide an underground system. The company will receive the contract for street lighting.

Escomb (Co. Durham).—VILLAGES AND ELECTRICITY.—There is stated to be a demand for electric lighting from a number of tradesmen and residents in Witton Park and Escomb, and the Parish Council has written to the North-Eastern Electric Supply Co., Ltd., asking what prospects there are of electricity being supplied to the villages.

Fareham.—CHEAPER ELECTRICITY.—The "unit" charge under the two-part tariff has been reduced from ¾d. to ¾d.

Faversham.—UNEQUAL CHARGES.—At a recent meeting of the Town Council it was stated that consumers of the Kent Electric Power Co. who live within the borough have to pay 8d. per kWh for electricity for lighting, compared with 5½d. paid by the consumers of the Corporation. The Council is to approach the company with a view to its charges being reduced.

Glasgow.—NO FLOODLIGHTING.—No action is to be taken regarding the proposed floodlighting of the City Chambers.

Hull.—EXTENSIONS AT DAGGER LANE.—The Electricity Committee is to extend the Dagger Lane buildings at a cost of £11,500. A sum of £1,500 is to be spent on lighting and heating, and an electric goods lift is to be installed.

MAINS AND SERVICES.—Application is being made to borrow £25,000 for assisted wiring and £75,000 for mains and services.

Irish Free State.—PIER LIGHTING.—The lighting installation on the east pier, Dun Laoghaire, near Dublin, shown in the accompanying illustration, covers over a mile of pier roadway.

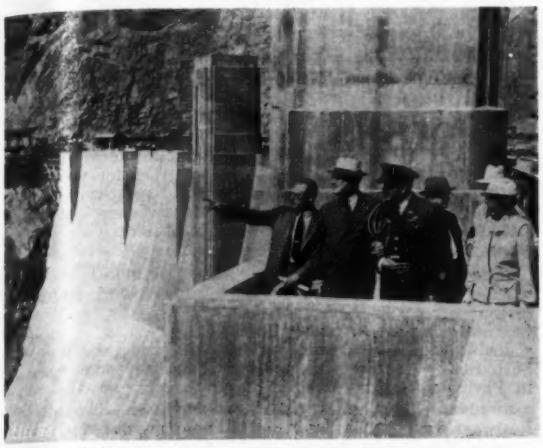
A night view of the new lighting on the east pier, Dun Laoghaire

The concrete standards are 22 ft. high, with double lanterns mounted at 20 ft. The lanterns are of a special design approved by the Dun Laoghaire Corporation, and comprise

500-W lamps with special Holophane axial "Duo-Dome" refractors, which give an asymmetrical beam of 180 deg. along the pier, thus putting the maximum light on the roadway and avoiding the light spill into the water on each side. The installation, which was designed by the Electricity Supply Board, in collaboration with Holophane, Ltd., was inaugurated by Senator E. J. Duggan, of the Dun Laoghaire Corporation, who switched the lamps on from the Royal Marine Hotel.

Kettering.—STREET LIGHTING.—The Ministry of Health has given permission for the Urban District Council to borrow £3,760 for extending the town's central-suspension lighting system.

Lancashire.—NEW POWER STATION CHIMNEYS AT KEARSLEY.—Two brick chimneys, each 325 ft. high and 15 ft. internal diameter at the top, are to be erected by the Lancashire Electric Power Co. at its Kearsley power station. They will cost nearly £16,000.



President and Mrs. Roosevelt viewing the Boulder Dam, Nevada, after taking part in the ceremony which marked its completion

Llandrindod Wells.—A REFRIGERATOR TARIFF.—The Urban District Council has reduced the tariff for refrigerators to 2½d. per kWh.

London.—FULHAM.—An expenditure of £480,500 for the further extension of the power station, at the request of the Central Electricity Board, has been approved. The extension includes one 60,000-kW turbo-alternator with two 260,000-lb. boilers. The Committee recommends the appointment of Messrs. Preece, Cardew & Rider, and Mr. A. J. Fuller, as joint consulting engineers for the scheme.

The Electricity Committee, reporting on the provision of a supply of electricity to the proposed new exhibition hall at Earl's Court, states that this will involve an expenditure of £28,000 for switchgear and cables and £40,000 for sub-station equipment.

Reductions in charges are to be made as follows: Heating, power and cooking supplies, from ¾d. to ½d. per kWh; street lighting, from ¾d. to ½d. per kWh; domestic schemes "A" and "B," from 1½d. to ¾d. per kWh; and "all-in" lighting, heating and cooking, from ¾d. to ½d. per kWh (plus standing charges); revised rates for domestic scheme "C" are 1½d. per kWh up to 400 kWh, with a minimum charge of 350 kWh, and 1d. per kWh for all electricity consumed if more than 400 kWh, with a minimum charge of 500 kWh.

POPLAR.—Speaking at a recent meeting of the Borough Council, Alderman C. W. Key, chairman of the Electricity Committee, recalled that early in the year the Department had set out to install 2,000 cookers during the ensuing twelve months. So successful had been the campaign; he said, that 2,300 cookers were installed within nine months, and he intimated that the Electricity Committee hoped to submit proposals with regard to further extensions in the matter of domestic supplies of electricity.

WANDSWORTH.—The Borough Council has decided to light over sixteen miles of main roads for the first time by electricity. Approximately 500 new steel columns will be erected, each fitted with a 500-W filament lamp in a special lantern.

Malling.—OVERHEAD LINES.—The Rural District Council has consented to the erection of overhead lines by the Kent Electric Power Co. and the Maidstone Corporation at Borough Green, Ditton, Aylesford, Wateringbury and Shipbourne.

Middlesbrough.—DEVELOPMENT CAMPAIGN.—Mr. H. Haigh, the borough electrical engineer, has prepared a report for the approval of the Town Council on methods of increasing the sale of electricity in the town, despite keen competition from low-priced gas. Mr. Haigh states that Middlesbrough holds an unenviable position in being near the bottom of the table regarding the sale of electricity per head of the population. In order to increase the sale of energy he suggests the introduction of a suitable tariff, reasonable hire and hire-purchase facilities, the provision of adequate showrooms and publicity. He proposes a fixed charge of £2 10s. for houses of not more than 850 sq. ft., and up to £6 for houses of 2,550 sq. ft., with a "unit" charge of ½d. in the borough (25 per cent. extra for outside consumers), and a discount of 10 per cent. for prompt payment. Mr. Haigh also appends a suggested revised list of hire charges.

Northern Ireland.—ELECTRIFICATION SCHEME.—The scheme for the electrification of Northern Ireland advanced a stage further during the week, when, in the presence of representatives of the Electricity Supply Board for Northern Ireland, the bulk supply of the entire area from Derry to Omagh was transferred from Belfast to the Londonderry power station.

GENERATION OF ELECTRICITY.—The official return furnished by the Ministry of Commerce shows that 34,975,143 kWh of electricity was generated by authorised undertakings in Northern Ireland during the quarter ended September 30th, as compared with 29,365,765 kWh in the corresponding quarter of 1934, representing an increase of 5,609,378 kWh, or 19.1 per cent. The total number of kWh generated during the first nine months of 1935 up to the end of September was 116,305,490, compared with 96,851,751 kWh for the corresponding period of 1934, an increase of 19,453,739 kWh, or 20.1 per cent.

Norway.—ELECTRICITY PRODUCTION.—The recently published "Statistical Annual, 1935," shows that there were 2,551 power plants in the country at the end of 1934, an increase of 49 during the year, and their total aggregate capacity was 1,856,550 kW.

Oxford.—IMPORTANT STREET LIGHTING SCHEME.—The City Council has approved a recommendation of the Highways (Street Lighting) Sub-Committee that roads and streets within the old city boundary (approximately 12½ miles in length) shall be lighted by electricity, and that application shall be made for sanction to a loan of £15,000 to cover the cost.

Plymouth.—CHANGE OF VOLTAGE.—It is reported that, in connection with the proposed change of pressure in the St. Budeaux area, the Electricity Commissioners have suggested that the alteration should be made in the whole of the Council's area of supply, and the Electricity Committee agreed to do so, it being pointed out that there is no obligation to carry out the alteration in any specified time.

St. Andrews.—PROPOSED CHANGE-OVER.—The Electric Supply Corporation, Ltd., has asked the Town Council to approve a proposal to change the system of supply from d.c. to a.c. The tariff rates for supply to ordinary consumers, it is stated, will be no less favourable than those of the Fife Electric Power Co., which supplies a.c. to the town. The Council is obtaining expert advice on the Corporation's proposals.

Spalding.—EXTENSION.—The Urban District Council has decided to extend its supply to Weston, at an estimated cost of £1,500, subject to a guarantee, and a loan has been applied for to cover the outlay.

ELECTRICITY AND RATE RELIEF.—In spite of the combined efforts of the Electricity and Gas Committees to prevent it, the Urban District Council has decided that the profits from both undertakings shall be used for the relief of rates.

South Africa.—SCHEME FOR CERES.—The Ceres Town Council, Cape Province, has received a report on the proposed new electricity undertaking which has been prepared by Mr. G.

Floodlighting in Kelsey Park, Beckenham, in connection with the Charter celebrations

Adendorff, consulting engineer, Cape Town. The scheme, which will cost £8,000, is being submitted to the ratepayers.

Stanley (Co. Durham).—LOWER ELECTRICITY CHARGES.—For the domestic supply a rebate of 3½d. per kWh is to be made on consumptions over 120 kWh, instead of 180 kWh. For the commercial supply the price has been reduced from 5d. to 4½d. per kWh, while in the case of prepayment slot meters the charge has been reduced from 6d. to 5d. per kWh, with a rebate of 3½d. per kWh over 120 kWh. These new charges were brought into operation on October 1st.

Stroud.—OVERHEAD LINE.—The Rural District Council has approved the erection of an overhead line at Cainscross by the West Gloucestershire Power Co., Ltd.

Sutton Coldfield.—SUPPLY TO ESTATE.—The Electricity Committee is to provide supply to the Berwood Farm estate, where 137 houses are to be built.

RURAL SUPPLIES.—Mains are to be extended at a cost of £1,247 to provide supply to the rural areas of Walmley Ash.

LOWER CHARGES.—The borough electrical engineer (Mr. T. Bloore) informs us that reductions have been made in the electricity charges, as follows: Lighting, under 1,000 kWh per quarter, 4½d. per kWh (previously 4½d. under 750 kWh); 1,000 to 2,000 kWh, 4d. (4¼d.); over 2,000 kWh, 3½d. (3¾d.). The present two-part tariff "unit" charges of 1d. and ¾d. are reduced to ¾d. and ½d. respectively.

Sweden.—POWER PRODUCTION.—The Department of Statistics recently published a survey of Sweden's electricity production and consumption in 1934. The total production was 6,033 million kWh, of which 5,334 million kWh was utilised. These figures show a considerable increase over the preceding year. The highest relative increase comes under the heading of traction, in which category the consumption has risen by 27.9 per cent., mainly due to the progressive electrification of railways. The gross value of the total consumption was about £8,400,000 in 1934, as compared with £7,969,000 the year before.

HYDRO-ELECTRIC DEVELOPMENT.—The Swedish Waterfall Board, in submitting to the Government its application for Budget allowances for next year, asks for an allowance of Kr. 10,300,000 (about £540,000 at the present rate of exchange) for the extension of its power-distribution system, learns *Reuters Trade Service* from Stockholm. Such extensions will be particularly large next year owing to the execution of the programme for combining the northern power production system (Porjus and Stadsforsen hydro-electric power stations, &c.) and the Central Swedish system (the centre of which is Vaesteras).

Switzerland.—STREET LIGHTING.—In a recent issue of the Bulletin of the Association Suisse des Electriciens, M. J. Guanter gives the results of an inquiry into public street lighting in Switzerland in 1933. The inquiry showed that, in the country as a whole, electricity was responsible for 96 per cent. of the total and gas for only 4 per cent. The capacity of the installed electric lamps at the end of 1933 was 15,860 kW, and the total annual consumption of power about 53 million kWh.

Worthing.—SUPPLY EXTENSION.—The Electricity Committee is to provide supply to the Willowhayne estate, East Preston, at a cost of £1,857.

Traction

France.—RAILWAY CONSUMPTION.—In 1934 the Paris-Orléans-Midi Railway's electrified services consumed 327,000,000 kWh, of which 167,000,000 kWh was used on the Midi section and the remainder on the section from Paris to Vierzon and Tours. The total distance covered by electric trains was 14,531,194 km. on the Midi (representing 46 per cent. of the company's total) and 11,216,293 km. on the P.O. (20 per cent. of the total). Regenerative braking tests undertaken a short time ago on the newly opened Vierzon-Brive line showed that one of the 4,000-h.p. express locomotives could hold a train of 900 tons on a 1-in-100 gradient at all speeds from 56 to 15 m.p.h.

Germany.—GLASS-TOPPED RAIL-COACHES.—Several two-motor vehicles of 480 h.p. put into service on the Bavarian division of the German State Railways recently have glass roofs and deep observation windows right round the sides and ends, as

One of the new German 480-h.p. rail-coaches

may be seen from the accompanying illustration. They have been introduced to encourage tourist traffic on the mountain lines and carry seventy-two passengers on a tare weight of 49 tons, operating on the standard Reichsbahn supply of 15-kV single-phase.

Holland.—SEASIDE LINE OPENED.—Electric services on the 1,500-V d.c. system between Haarlem and Zandvoort began on October 6th. Electrification has enabled the time between Amsterdam and Zandvoort to be reduced from thirty-four to twenty-six minutes.

Italy.—NEW ELECTRIC RAILWAY LINES.—With the opening on October 28th of the Rome to Florence and Rome to Naples main lines to 3,000-V electric traction the Italian State Railways will have completed the electrification of 450 route-miles of line since Easter. The other lines include the Udine to Tarvisio section, the Naples to Villa Literno route (previously 600-V d.c.), Prato to Pistoia (previously 3,600-V three-phase), and a portion of the Rome to Sulmona division (previously 10,000-V three-phase). It is further reported that the Trieste to Udine line has been completed.

Japan.—DIESEL-ELECTRIC TRACTION.—A report from our Yokohama correspondent states that the I.G.R. authorities have decided to run Diesel-electric cars on the State railways. About 1,000,000 yen will be set aside for the purpose, and three-coach trains will be used.

Liverpool.—TRAMWAY EXTENSIONS.—The Ministry of Transport has agreed to proposed tramway extensions involving eleven new routes in various parts of the city.

London.—INTRODUCTION OF TROLLEY-BUSES.—We understand that the trams now running between Shepherd's Bush and Hammersmith and Hounslow and Hampton Court *via* Kew are to be replaced by trolley-buses next month.

Southern Railway.—RAILWAY ELECTRIFICATION.—Work has begun on the electrification of the Southern Railway line from Weybridge to Virginia Water and Staines.

Spain.—MADRID-AVILA ELECTRIFICATION.—The conversion of the Northern Railway of Spain main line from Madrid to Avila and from Villalba to Segovia is proceeding slowly, although definitely authorised in 1934. The contract for the erection of the overhead contact line structures has been awarded to the Soc. Espanola de Montajes Industriales at a price of 7,135,000 pesetas; the time limit for completion is just under three years.

Sunderland.—TRAMWAYS EXTENSION SCHEME.—A £16,600 scheme for extending the tram track from the Fulwell terminus to the Seaburn terminus has been approved by the Transport Committee. The proposed extension, which is to consist of a double tram track, will be along Dykeland Road and Whitburn Road to Seaburn. The Council recently promoted a Bill in Parliament which gave it power to carry out the work.

Sweden.—RAILWAY ELECTRIFICATION.—The Swedish State Railways have asked the Budget Committee to grant £386,000 to electrification works during the new fiscal year. The suggested allowance comprises £85,000 for electric locomotives, £177,300 for electrification of the lines from Laxa to Charlottenberg, Södertälje to Eskilstuna and Uppsala to Gävle, and £123,700 for extension of electrification works now in progress. It is also proposed to electrify the railway lines from Orebro to Svarta, Skebokvarn to Stalboga and Skövde to Karlsborg at a total cost of £214,400. This expense can, however, be met out of the allowance originally granted for the electrification of other lines in the province of Scania, as these works have cost £370,000 less than estimated.

Communications

Fiji.—RADIO SERVICES.—Mr. L. A. Hooke, deputy general manager of Amalgamated Wireless (Australasia), Ltd., has announced that the Fiji Government has concluded an agreement with the company for the continuance of the overseas radio services to the Fiji Islands for a further period of years.

Germany.—TOWER COLLAPSES.—In a violent gale which swept the Rhineland and Western Germany last week the 530-ft. high transmission tower of the Cologne broadcasting station at Langenberg was blown down.—*The Times.*

Great Britain.—AIRCRAFT RADIO.—Representatives of the Air Ministry visited Inverness last week to inspect the municipal aerodrome in connection with a proposal to establish a radio station there for the direction of aircraft on long-distance routes.

RADIO LICENCES.—At the end of September 7,224,123 licences were in force in this country, representing an increase of 49,007 during the month and an increase of 750,133 since the beginning of the year.

POPULARISING THE TELEPHONE.—A new estate near Knutsford, Cheshire, is to have telephones installed by the builders, who will pay the installation fee and first year's rental.

MEDITERRANEAN CABLE REPAIRS FOR SPANISH GOVERNMENT.—The Telegraph Construction & Maintenance Co.'s cable ship *Dominia* left London last week to carry out repairs to the Spanish Government's submarine telegraph cable system in the Mediterranean Sea. The *Dominia* is expected to take about six weeks to complete the work, which consists of thirteen separate repairs, including the complete renewal of the heavily armoured shore ends. The ship was originally built for laying the world's longest cable between Vancouver and Fanning Island.

India.—TELEPHONE PROGRESS.—Rapid progress has been made in constructing telephone connections, and within two months Bombay will be linked with Bangalore, in the Mysore territory, states our Bombay correspondent. In addition, the Madras to Bangalore and Madras to Calcutta services are expected to be inaugurated by next January. The Government of Mysore has decided to provide another line of a larger carrying capacity over the existing poles with a view to enabling Mysore to take advantage of the connection of Bangalore and the telephone trunk system. All the coastal towns between Madras and Calcutta will be linked by the end of the year.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—BRISBANE.—November 26th. City Electric Light Co., Ltd. Switchgear, including control panels, instrument transformers, switches, circuit-breakers, &c., for the Bulimba power station. (T.Y. 10150.)*

Birmingham.—November 5th. Electric Supply Department. Motor convertors. (October 11th.)

Breconshire.—October 31st. Education Committee. Electric lighting at Brynmawr Senior school. H. C. W. Strickland, County architect, Watton Offices.

Carlisle.—October 21st. Electricity Department. Transformers. (September 27th.)

Glitheroe.—November 4th. Electricity Department. Three switchboards. (See this issue.)

East Grinstead.—October 29th. U.D.C. 6,600-V outdoor substation equipment. (See this issue.)

Egypt.—CAIRO.—November 2nd. Ministry of the Interior. Diesel generating plant for the Damietta power station. (T.Y. 10138.)*

November 7th. L.c. armoured cable, l.p. switchgear, insulators and pole line hardware for El Arish. (T.Y. 10136.)*

November 25th. Electrical measuring instruments for the Damanhour power station. (T.Y. 10135.)*

Ministry of Public Works. November 11th. Electrically driven centrifugal pumping plant, motor generator set, overhead network, lanterns and poles. (T.Y. 5385.)*

Glasgow.—Public Assistance Department. Fire alarm apparatus and wireless equipment. (See this issue.)

October 24th. Corporation. Electrical installations in 198 houses. Town clerk's office (Room 36).

Harefield.—November 11th. Middlesex County Council. Automatic telephone system, cabling and instruments, &c., for the County Sanatorium. (See this issue.)

Hastings.—November 4th. Electricity Department. Transformers, poles, galvanised steelwork, &c. (See this issue.)

Hazel Grove and Bramhall.—October 31st. Electricity Department. Sub-station l.p. switchgear. (See this issue.)

Holbeach.—November 21st. Holland C.C. Engineering works in connection with Holbeach Institution. (See this issue.)

India.—NEW DELHI.—October 30th. Stores Department. Train lighting batteries. (T.Y. 10156.)*

November 28th. Flameproof electric cables as required under an annual rate contract. (T.Y. 10155.)*

Irish Free State.—DUBLIN.—October 25th. Electricity Supply Board. 25,000-kVA, 5/38-kV transformer. (September 20th.)

Langho (near Blackburn).—Lancashire Mental Hospitals Board. Electrical installation for extensions to Brockhall Institution. (See this issue.)

London.—SOUTHWARK.—October 23rd. Borough Council. Cables. (October 11th.)

STOKE NEWINGTON.—Electricity Department. Underground disconnecting boxes. (See this issue.)

Manchester.—October 18th. Electricity Committee. A.c. electric fan motors. (October 4th.)

Middlesbrough.—October 24th. Town Council. Electric lighting and power at the new scarlet fever block at the West Lane Hospital. S. E. Burgess, borough engineer, Town Hall.

New Zealand.—WELLINGTON.—November 25th. Posts and Telegraph Department. Ammeters, voltmeters, and high- and low-voltage relays. (T.Y. 10127.)*

January 28th, 1936. Public Works Department. 50-kV switchgear and steelwork for Section 425 of the Arapuni scheme. (T.Y. 10154.)*

January 21st. 110-kV switchgear and steelwork for the Paraparaumu sub-station. (T.Y. 10152.)*

DUNEDIN.—December 9th. City Corporation. One 7,500-kVA, 6,600-V, three-phase, 50-cycle, totally enclosed, self-ventilating synchronous condenser. (T.Y. 10124.)*

Norwich.—Electricity Department. Turbo-alternator and condensing plant, water tube boilers, pipes, valves, &c., ash sluice conveyor and reclaiming plant, and 400-V and 3,300-V switchgear and transformers. (See this issue.)

Rochdale.—October 23rd. Electricity Department. Meters. (October 11th.)

St. Helens.—October 23rd. Electricity Department. Cables. (October 11th.)

Staffordshire.—November 11th. Potteries Water Board. Two sets of electrically-operated rotary pumps; also one Diesel-driven d.c. generating set. P. Wilkinson, engineer, Staffordshire Potteries Water Board, Albion Street, Hanley, Stoke-on-Trent (deposit £5).

Swansea.—October 18th. Electricity Department. Interior and exterior lighting installations, heating circuits, &c., at Tir John power station. (September 27th.)

Turiff (ABERDEENSHIRE).—October 26th. Town Council. Electric street lighting installation. Burgh surveyor.

Uruguay.—MONTEVIDEO.—November 25th. State Electricity Supply and Telephone Administration. 75,000 40-W, 225-V, and 1,500 500-W, 225-V electric lamps. (T.Y. 10137.)*

Walkington.—October 29th. East Riding Mental Hospital Visiting Committee. Installation of electric lighting at mental hospital. (October 11th.)

Whitburn.—Town Council. Wiring for lighting, heating, and power of 186 houses. D. D. Sandeman, town clerk, National Bank Buildings, Bathgate.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Acton.—General Purposes Committee. Accepted. Electric lighting at Turnham Green school (£127).—Waring, Withers & Chadwick.

Australia.—COMMONWEALTH.—P.M.G.'s Department. Accepted. Bells and buzzers (£394).—Phœnix Telephone & Electrical Works, Ltd. Valves for broadcasting stations and studios (£458).—Standard Telephones & Cables (A'sia), Ltd. V.i.r. l.c. cable (£276).—W. T. Henley's Telegraph Works Co., Ltd. Submarine cable between mainland and Tasmania.—Siemens Bros. & Co., Ltd. (£101,534); Standard Telephones & Cables (A'sia.), Ltd. (£60,490). Relays (£201).—Automatic Telephones Pty., Ltd. —*Tenders.*

Birmingham.—Electricity Committee. Accepted during the past quarter: Rewinding of turbo-alternator set at the Prince's generating station, six reactances at Hams Hall power station, six transformers for Sparkbrook and Cheapside sub-stations and transformers and reactances at Hams Hall and Summer Lane power stations and Water Street sub-station.—General Electric Co., Ltd. High and low-pressure steam piping, &c., at Hams Hall power station.—Stewarts & Lloyds, Ltd. Meters.—Ferranti, Ltd.; British Electric Meters, Ltd.; Chamberlain & Hookham, Ltd.; British Sangamo Co., Ltd.; Measurement, Ltd.; Electrical Apparatus Co., Ltd. Three pulverised fuel boilers at Hams Hall power station.—International Combustion, Ltd. On-load tap-changing gear for three transformers at Nechells generating station.—Ferranti, Ltd. Water sluice ash disposal plant at Hams Hall power station.—Stevensons, Ltd. Traction mercury arc rectifier at Waterloo Road sub-station.—Hewittic Electric Co., Ltd. Three transformers at Hams Hall power station.—Electric Construction Co., Ltd. Three transformers for Chester Street sub-station and three reactances for Hams Hall power station.—Yorkshire Electric Transformer Co., Ltd. Cable jointing compound for twelve months ending June 30th, 1936.—Limmer & Trinidad Lake Asphalt Co., Ltd. Circuit-breakers.—Ferguson Pailin, Ltd.

Dumfries.—Corporation. Accepted. Kiosk equipment (£272). —Crompton Parkinson, Ltd.

Finchley.—Fire Brigade Committee. Accepted. Fire alarm system (£4,859).—Automatic Electric Co., Ltd.

Glasgow.—Cleansing Committee. Accepted. Four electric vehicles (£1,175 each).—Richard Garrett Engineering Works, Ltd.

Housing Committee. Accepted. Electrical installation at Fulton Street (£1,591).—A. A. Moore. Electrical installation at Montrave Street (£139).—Darroch & Espie.

Public Assistance Committee. Accepted. Main circuit-breaker equipment, &c., for nurses' home at Lennox Castle Institution.—M. & C. Switchgear, Ltd.

Hebburn-on-Tyne.—U.D.C. Accepted. Electrical installation in sixty-six houses (£236).—J. McCabe, Jarrow-on-Tyne.

Isle of Ely.—Education Committee. Accepted. Electric lighting in the March North District Infants' school and two adjoining houses (£206).—W. Palmer & Son, March.

Kettering.—Electricity Committee. Recommended. Battery for 3½-ton electric vehicle (£200).—Chloride Electrical Storage Co., Ltd. Extension to existing truck type switchboard at the Desborough sub-station (£147).—Ferguson, Pailin, Ltd. One 250-kVA transformer (£175).—Brush Electrical Engineering Co., Ltd. One outdoor mounting, switching kiosk, &c., in connection with the supply to Isham (£125), transformer kiosk for Warkton Lane (£82), and three unit e.h.p. switchgear (£161).—Crompton Parkinson, Ltd.

Lanarkshire.—County Council. Accepted. Electric lighting at new nurses' home at Hairmyres Colony (£883).—S. Harvie, Wishaw.

London.—WESTMINSTER.—Highways Committee. Accepted. Traffic signals at Northumberland Avenue (£2,462) and Vauxhall Bridge Road (£1,575).—Automatic Electric Co., Ltd.

Recommended. Rectifying equipment, including switchgear and instruments (£226).—Electrical Equipment & Carbon Co., Ltd.

STOKE NEWINGTON.—Electricity Committee. Recommended. Change-over of motor installations to a.c. at premises in the Dynevor Road area (£630).—Norvall Bros., Ltd. Conversion of electric lift (£82).—Titan Lift Co.

Peterborough.—Town Council. Accepted. Overhead line for the supply to operate new sluices and a lock being constructed by the Nene Catchment Board (£584).—Transmission Lines & Cables Construction Co.

Scarborough.—Town Council. Accepted. Electric lighting in connection with proposed additions at the public library buildings (£522).—A. S. Toland.

Stirlingshire.—Education Committee. Accepted. Electricity at the new Raploch school (£246).—D. Reid, Larbert.

Stranraer.—Accepted. Electrical work at new elementary school (£284).—R. Scott & Son.

Sutton Coldfield.—Electricity Committee. Accepted. Supply and erection of two transformer kiosks (£756).—General Electric Co., Ltd.

Swansea.—Drainage Committee. Accepted. Electric wiring at storage tanks (£364).—Colston Electrical Co., Ltd.

Electricity Committee. Accepted. Laboratory equipment, machine tools, &c. (£1,877).—J. W. Carr & Co.

Warrington.—Electricity Committee. Accepted. Cable slabs and service box covers.—S. H. Bonsall, Stockport. Conduits.—Doulton & Co., Ltd., Lambeth. Cables.—British Insulated Cables, Ltd. Hard drawn stranded copper.—Whitecross Co., Ltd.

Worthing.—Electricity Committee. Accepted. Three kiosks (£719).—Johnson & Phillips, Ltd. Three transformers (£523).—British Electric Transformer Co., Ltd.

Forthcoming Events

Birmingham Electric Club.—Friday, October 18th. Grand Hotel. 7 p.m. Ladies' night. Friday, October 25th. Grand Hotel. 7 p.m. "The Use of Auxiliary Commutator Motors for Power Factor Correction." Mr. P. A. Mossay.

Institution of Mechanical Engineers.—Friday, October 18th. Annual dinner. Friday, October 25th. Institution, London. Presidential address by Col. A. E. Davidson.

Association of Supervising Electrical Engineers.—Saturday, October 19th. Criterion Restaurant, W.1. 6.30 p.m. Dinner and dance.

Electrical Power Engineers' Association (*London Technical Group*).—Monday, October 21st. Caxton Hall, S.W.1. 7.15 p.m. "The High Rupturing Capacity Fuse." Mr. A. M. Pooley. (*Manchester Section*).—Saturday, October 19th. Grand Hotel, Manchester. 6 for 6.30 p.m. Dinner and dance.

Institution of Electrical Engineers.—Thursday, October 24th. Institution, London. 6 p.m. Presidential address by Mr. J. M. Kennedy. (*North-Eastern Students' Section*).—Friday, October 18th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Address by Mr. T. D. Oswald on "Lightning." (*Tees-Side Sub-Centre*).—Monday, October 21st. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. Address by Mr. D. B. Hogg. (*East Midland Sub-Centre*).—Tuesday, October 22nd. The College, Loughborough. 6.45 p.m. "Droitwich Broadcasting Station." Sir N. Ashbridge and Messrs. H. Bishop and B. N. MacLarty. Friday, October 25th. Victoria Hotel, Nottingham. Annual dinner. (*North-Western Centre*).—Tuesday, October 22nd. The Engineers' Club, Manchester. 7.15 p.m. Chairman's address by Mr. E. C. McKinnon. (*Bristol Students' Section*).—Friday, October 25th. Pavilion Ballroom, Bristol. Annual dance. (*North-Eastern Centre*).—Saturday, October 26th. 1.45 p.m. Visit to the Dunston Power Station.

Junior Institution of Engineers.—Friday, October 25th. 39, Victoria Street, S.W.1. 7.30 p.m. Informal meeting. "Luminous Discharge Tubes." Mr. C. C. Paterson.

Notes

Bolton Corporation and the Grid

The official opening of the new switchgear building at Back o' th' Bank generating station, Bolton, took place on October 9th. The switchgear and other apparatus was described in our issue of October 11th. The Mayor (Ald. J. P. Taylor) presented Ald. Roberts (chairman of the Electricity Committee), who performed the opening ceremony, with a gold key and unveiled a bronze tablet bearing the names of the committee members and officials, at the same time illuminating a neon sign bearing the letters "B.C.E.D.-C.E.B." interlinked. The new thermal-storage high-voltage electrode boilers (by Messrs. A. Reyrolle & Co.) were also inspected. This plant, comprising two 1,750-kW units automatically controlled by time-switches and thermostats, is at present heating the Town Hall and the Courts, and will eventually provide heat for the whole of the Civic Centre buildings when these are completed.

At the dinner held in the town hall Mr. C. T. S. Arnett (C.E.B.) said that with co-operation of the kind given by Bolton Electricity Department the Board hoped to achieve better results in the N.W. England region than anywhere else, although the area was the second worst in trade depression. Last month Bolton's increase of output was 23 per cent. in excess of that for September, 1934, compared with 9.75 per cent. for the whole area. Ald. Roberts stated that during the past financial year 3,478 consumers had been connected—more than in any previous year. The mains had been extended by fifty miles and three new sub-stations and thirty-three kiosks had been erected. The kWh sent out showed an advance of 10.3 per cent. Councillor Winkley stated that the new switchgear building had cost £16,500 and the equipment £74,000. Lt.-Col. K. G. Maxwell (Met.-Vick) presented a silver candelabra to Ald. Roberts on behalf of the contractors and commended the design of the control room, for which Mr. H. E. Annett, the borough electrical engineer and manager, had been responsible.

I.E.E. (Meter and Instrument Section) Dinner

The annual dinner of the Meter and Instrument Section of the Institution of Electrical Engineers will be held on November 15th at Pagani's Restaurant, Great Portland Street, W.

Two New E.A.W. Branches

Another branch of the Electrical Association for Women has been formed in Falkirk and district and the following officers have been appointed: President, Mrs. Kennard; chairman, Mrs. Fraser; secretary, Mrs. Allan, Electricity Department, Falkirk; treasurer, Mrs. A. G. Logan; committee, Mrs. A. Lawrie, Mrs. G. Lindsay, Mrs. Climie, Mrs. M'Laren, Mrs. Blackadder, and Mrs. T. Cassells.

The inaugural meeting of the proposed new West Kent Branch of the Association will be held at the Village Hall, Orpington, on October 31st, at 3 p.m. The chair will be taken by Lady Kemnal and the speakers will include Sir John Snell, chairman of the Electricity Commission, Mr. J. C. Dalton, manager and secretary of the County of London and Associated Companies, and Miss Caroline Haslett, director of the E.A.W.

Generation of Electricity in September

The official returns rendered to the Electricity Commissioners show that 1,320 million kWh of electricity was generated by authorised undertakers in Great Britain during September, as compared with the revised figure of 1,142 million kWh in the corresponding month of 1934, representing an increase of 178 million kWh, or 15.6 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was twenty-five, the same as last year.

During the first nine months of 1935 up to the end of September the total amount of electricity generated by authorised undertakers was 12,227 million kWh, as compared with the revised figure of 10,875 million kWh for the corresponding period of 1934, representing an increase of 1,352 million kWh, or 12.4 per cent.

	1934. kWh. (millions).	1935. kWh. (millions).	Increase per cent.
January	1,536	1,714	11.6
February	1,343	1,478	10.0
March	1,391	1,507	8.3
April	1,188	1,330	11.9
May	1,125	1,326	17.9
June	1,049	1,147	9.3
July	1,042	1,216	16.7
August	1,059	1,189	12.3
September	1,142	1,320	15.6

The New E.R.A. Laboratory

The new laboratory of the British Electrical and Allied Industries Research Association at Perivale will be opened on Tuesday next by the Duke of Kent. Owing to the limited accommodation on the first day, and to meet the convenience of country members who may be in London on October 23rd, invitations to inspect the laboratory are being extended over the afternoon of the second day.

The Engineers' Club Manchester

The Engineers' Club, Manchester, celebrated its "coming of age" by a dinner at the Club on October 14th, 200 members and guests being present. The guests included the Lord Mayor of Banchester, the Mayor of Salford, Sir Andrew R. Duncan, Sir Felix J. C. Pole, Sir Percy Worthington, and Lieut.-Col. A. G. Lee (Chief Engineer of the Post Office). Mr. L. E. Mather, the president, was in the chair. The toast of "The Engineering Industry" was proposed by Mr. H. W. Archer, who dealt with the progress made in the various branches of engineering during the life of the Club. Mr. L. St. L. Pendred responded. The toast of the evening, "The Engineers' Club," was given by Sir Andrew Duncan, who outlined its history. He referred to the first steps taken in March, 1912, to found the Club, and said that the venture was an immediate success notwithstanding the War period, and in 1919 the membership had reached 829; the premises were then extended to double the original size and the site purchased. During recent years in common with all other clubs it has suffered from the general economic depression, the present membership being 450. In responding, the president mentioned the good work that the Club had done for engineering in Manchester and district, and emphasised the need for better support by the younger men engaged in the industry. An interesting feature was a toast to the founder members present, suitably responded to by one of the "ancients." "Our Guests" was proposed by Alderman W. Walker and responded to by Mr. W. E. Clucas.

Electric Heating Developments

In the article under the above heading in the Domestic Special issue of the ELECTRICAL REVIEW last week, on page 476 we referred to the largest high-temperature panels produced by Space Heating, Ltd., as measuring 25 ft. by 15 ft. This should have read 25 in. by 13 in.

Appointments Vacant

Junior mains engineer for the Stewartry of Kirkcudbright C.C. Electricity Department.

Power station assistant and assistant consumers' engineer for Plymouth Electricity Department.

Lady showroom assistant and demonstrator for Spalding Electricity Department.

Secretary/treasurer to the employers' side of the D.J.I.C. for the Electricity Supply Industry (No. 4 South Wales and Monmouthshire Area).

Director for Signals Experimental Establishment for the War Department, Woolwich.

Meter engineer for Bedford Electricity Department.

Mains Department assistant for Barrow-in-Furness Electricity Department.

Assistant mains engineer and shift charge engineer for Weymouth and Melcombe Regis Electricity Department.

(See our classified advertisements.)

Makers' Names Wanted

IMPERIAL electric iron.

OXFORD vacuum cleaner.

Small plate switch with protruding sphere for thumb actuation in place of tumbler knob.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. Williams, the new president of the South Wales branch of the Association of Mining Electrical Engineers, holds the post of chief electrical engineer to Messrs. Cory Bros. & Co., Ltd. He was formerly associated with the Lewis Merthyr and Great Western Collieries, and was previously electrical engineer to the Pontypridd Urban District Council. He has been a member of the South Wales branch of the Association for twelve years, being first elected to the Council five years ago.

Mr. H. Hurworth

Mr. H. Hurworth, the author of the article on "Time Limit Fuses" which appears on page 527 of this issue, holds the position of sub-stations engineer to the Leeds Corporation Electricity Department, and as such is responsible for all the sub-stations in the Leeds system.

Mr. G. Wansbrough has been elected a director of the British Power & Light Corporation, Ltd.

Major H. B. Riggall, commercial manager of Messrs. Ruston & Hornsby, Ltd., has been elected a member of the Council of the British Engineers' Association.

The Bournemouth Corporation has passed a resolution recording its appreciation of the services rendered for a period of forty years by **Mr. I. Bulfin,** on his retirement from the post of transport engineer and general manager. Mr. Bulfin, who joined the Corporation's staff in 1895, became borough electrical engineer in 1903, and in 1909 was promoted to the position of chief assistant and electrical engineer of the transport undertaking. He was appointed to the post he now vacates in 1911.

Miss G. M. Robinson, of the Bedford Corporation Electricity Department, has been appointed chief demonstrator and showroom assistant to the Darlington Electricity Department.

Mr. C. W. V. Davis, who has been with Philips Lamps, Ltd., for the past eight years, has now been appointed manager of the rectifier section of Philips Industrial.

Mr. E. P. Burdett, the author of the article on "Serving Rural Areas" which appears on page 526, holds the position of development engineer under Capt. J. M. Donaldson, M.Inst.C.E., M.I.E.E., chief engineer of the North Metropolitan Electric Power Supply Co., and its associated companies.

Mr. P. Terry, the only son of Mr. C. Terry, O.B.E., J.P., chairman of Messrs. Herbert Terry & Sons, Ltd., has now joined the company. Mr. Terry was educated at the Leys, Cambridge, and for two years has been obtaining financial experience with Messrs. Impey, Cudworth, Lakin-Smith, Goode & Co., chartered accountants.

Mr. P. Terry

The Association of Supervising Electrical Engineers announces that the following awards have been made in the W. E. Highfield Shield Competition, 1935:—Members' Section: First prize (£5 5s.) and shield to Mr. J. M. Reekie, London, for a paper on "Changing Conditions in the Electrical Industry; second prize (£3 3s.) to Mr. H. B. Mellor, Oldham ("The Electrical Equipment of Machine Tools"); third prize (£2 2s.) to Mr. J. C. Day, Letchworth ("Gas Displaced"); Associates' prize of £3 3s. to Mr. M. Mackenzie, London ("The Electrical Equipment of Working-class Block Dwellings"). The papers on "A Typical d.c.-a.c. Change-over," by Mr. W. J. Hargreaves, Hyde, and "Estimating," by Mr. W. R. Durtnall, London, are commended. The prize fund donors were as follows: Messrs. W. T. Glover & Co., Ltd.; the Revo Electric Co., Ltd.; the Sun Electrical Co., Ltd.; Sir William Noble; and Messrs. Ferranti, Ltd.

Mr. A. F. Gibson has been transferred from the London office of Messrs. Berkeley & Young, Ltd., to Leeds, upon his appointment as the company's North-Eastern representative. **Mr. P. Roebuck** has joined the company's staff as North-Western representative, with headquarters at Manchester. This increase in the sales staff will enable the company to give more personal service in Northern England.

Mr. A. F. Gibson

Mr. A. E. Jeans, A.M.I.E.E., of the Bedford Corporation Electricity Department, has been appointed chief assistant to Mr. A. W. Money, borough electrical engineer of Brentford and Chiswick. Mr. Jeans received his technical training at the Regent Street and Willesden Polytechnics. He served his apprenticeship with the British Thomson-Houston Co., and was later transferred to that Company's Outside Erection Department. He has also held appointments with the Ilford and Hammersmith Borough Councils.

Obituary

Prof. Sir J. C. M'Lennan.—The death occurred from heart failure on October 9th in a Paris-Boulogne train of Professor Sir John Cunningham M'Lennan, who was well known for his work on the production of helium and the super conductivity exhibited by certain metals and alloys at the low temperatures obtainable with the aid of that gas in liquid form. He was born in Ontario in 1867, of Scottish parents, and received his education at Toronto and Cambridge. He spent the greater part of his life at the Toronto University, holding the successive positions of assistant demonstrator in physics, demonstrator, assistant professor, and finally head of the Department of Physics, from which he retired in 1932, taking up his residence in this country. He retired from Toronto University with the title of Professor Emeritus and Visiting Professor of Physics. He was a Fellow of the American Association for the Advancement of Science, a member of the National Research Council of Canada, and other Canadian societies, and in this country was elected a Fellow of the Royal Society in 1915, being a Royal Medallist in 1927. He was president of Section A of the British Association in 1923. In May last year he delivered the Kelvin Lecture before the Institution of Electrical Engineers, his subject being "Electrical Phenomena of Low Temperatures." He was made a K.B.E. in the Birthday Honours last June.

The late Prof. Sir J. C. M'Lennan

Mr. D. J. Williams.—We regret to record the death in tragic circumstances of Mr. Daniel John Williams, electrical engineer to the Mynddislwyn Urban District Council. Mr. Williams was crossing a railway line when he was knocked down by a train. He was an associate member of the I.E.E., and area secretary to the A.S.E.E. He was forty-one years of age.

Mr. C. D. H. Braine.—The death is announced at Barcelona of Mr. Charles Dimond Horatio Braine, M.Inst.C.E., past-president of the South African Institution of Engineers.

Mr. C. W. R. Campbell.—The death has occurred of Mr. C. W. R. Campbell, distribution engineer of the Victoria Falls and Transvaal Power Co., Ltd. Mr. Campbell, who was sixty-three years of age, was born at Brassington, Derby. He served his apprenticeship at Burton-on-Trent, and later became assistant engineer to the London Electric Supply Corporation at the Deptford power station. After experience on the Continent he went to South Africa in 1895, and became chief electrical engineer to the Johannesburg Consolidated Investment Co. Joining the staff of the Victoria Falls and

Transvaal Power Co., he was appointed distribution engineer in 1909, and held this position until his death. Mr. Campbell was responsible for the first installation of wireless telephony in South Africa, which is still in use between the Witbank and Brakpan power stations. He was also largely responsible for the design and installation of the first broadcasting equipment in the Union under the auspices of the Associated Scientific and Technical Societies of South Africa; this equipment is still being used by the African Broadcasting Corporation at Bloemfontein. He was also a pioneer in colour photography. Two years ago he represented South Africa at the International Wireless Conference which was held in Belgium.

Mr. O. F. Junggren.—The death recently occurred at Schenectady, at the age of 70 years, of Mr. Oscar F. Junggren, who was born and educated in Sweden and was with the General Electric Co. of America for 44 years. The *Electrical World* states that he was one of the outstanding engineers in the States, and as a pioneer in the designing and development of steam power equipment he worked with Mr. W. L. R. Emmet, the G.E. Co.'s chief engineer, in designing and constructing the first large Curtis turbine, completed in 1903. This 5,000-kW machine was the forerunner of the giant electric power producers in general use to-day. Appointed design engineer of the G.E. turbine department in 1907, Mr. Junggren continued in that position until 1922, when he became consulting engineer of the department. He had more than 130 patents to his credit and in the eight years from 1924 to 1932 he developed thirty steam turbines, all of them of different and outstanding design.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Electric Steels, Ltd.—Private company. Registered October 12th. Nominal capital, £55,000 in 196,000 7 per cent. preferred ordinary and 24,000 ordinary shares of 5s. Objects: To carry on the business of ironfounders, steelmakers, refiners and rollers, blast furnace proprietors, smelters, tinplate makers, brass, copper, bronze, lead and zinc workers, manufacturers of and dealers in forgings, castings, steel and armour plates, locomotives, boilers, engines, turbines, dynamos, &c. The directors are: E. G. Batt, 34, Vernon Court, Hendon Way, N.W.2; W. H. Clark, 195, Boston Manor Road, Brentford; H. A. Greaves, Meadow Brook Road, Sheffield; and F. A. de Silver (permanent), 80, Eccleston Square, Westminster, S.W.1. Registered office: 6, Duke Street, W.C.2.

George Nobbs (1935), Ltd.—Private company. Registered October 5th. Capital, £1,500 in £1 shares. Objects: To acquire the business of electrical and hot-water contractors and engineers carried on by George Nobbs, Ltd., at 87 and 89, Cleveland Street, Euston Road. The directors are: Major C. G. Nobbs, 65, Haverstock Hill, N.W.3; and G. H. Lacy, 21, Rochester Terrace, N.W.1. Major C. G. Nobbs is permanent governing director and chairman. Solicitors: Bulcraig & Davis, 12, Norfolk Street, W.C.2.

H. S. Phillips & Co. (Electrical Engineers), Ltd.—Private company. Registered October 7th. Capital, £6,000 in £1 shares. Objects: To acquire the business of an electrical engineer heretofore carried on by H. S. Phillips at 14, The Centre, Weston-super-Mare. The directors are: H. E. Phillips (managing director), 12, The Centre, Weston-super-Mare; L. E. Titley, Northwood, 68, Bristol Road, Weston-super-Mare; and O. M. Phillips, 12, The Centre, Weston-super-Mare.

Vitaleo Electrical Products, Ltd.—Private company. Registered October 7th. Capital, £3,000 in 2,000 10 per cent. cumulative redeemable preference shares of £1 and 4,000 ordinary shares of 5s. each. Objects: To carry on the business of manufacturers, importers and exporters of, agents for, and wholesale and retail dealers in electrical and mechanical appliances, instruments and devices, &c. The permanent directors are: J. F. Teague, "Penwith," 3, Crosslands Avenue, Ealing Common, W.5; and E. J. Straker, 49, Erpingham Road, Putney, S.W.15. Secretary: F. S. Murrells. Registered office: 329, High Holborn, W.C.1.

Ponsford & Co., Ltd.—Private company. Registered in Edinburgh, October 7th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a radio dealer and wireless and electrical engineer, &c., now carried on at 22, Cowgate, Dundee, by Mrs. E. I. S. Ponsford. The first directors are: S. J. Ponsford and Mrs. E. I. S. Ponsford, both of 49, Monifieth Road, Broughty Ferry. Registered office: 22, Cowgate, Dundee.

H. J. Osborn & Sharp, Ltd.—Private company. Registered in Edinburgh October 8th. Capital, £4,000 in £1 shares. Objects: To carry on business of electrical engineers and contractors, mechanical and general engineers, &c. The first directors are: H. J. Osborn, Burnside, Old Kilpatrick, and W. Sharp, 32, Barrington Drive, Glasgow. Registered office: 18, Gibson Street, Glasgow.

Follsain Tubular Products, Ltd.—Private company. Registered October 12th. Nominal capital. £2,000 in £1 shares. Objects: To adopt agreements (1) with Follsain Syndicate, Ltd., and Follsain Metals, Ltd., and (2) with the British Mannesmann Tube Co., Ltd., and to develop and turn to account the rights, patents and processes applicable to tubular products, and other matters and rights specified therein. The business is to be managed by the British Mannesmann Tube Co., Ltd. The directors are to be nominated in equal numbers by Follsain Syndicate, Ltd., and the British Mannesmann Tube Co., Ltd. The first directors are: A. H. Pollen, 238, St. James' Court, S.W.; H. Orkin, 10, Templewood Avenue, N.W.3 (directors and nominees of Follsain Syndicate, Ltd.); H. L. Armstrong, Coral Court, Sunningdale; and E. Smith, Ingleside, Fields Park Crescent, Newport, Mon. (directors and nominees of British Mannesmann Tube Co., Ltd.). Secretary: Herbert A. Bonney. Registered office: Halifax House, 62-4, Moorgate, E.C.

Doble Engineering, Ltd.—Private company. Registered October 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of consulting engineers in connection with electrical insulation, &c. The directors are: F. C. Doble and P. W. Davis, addresses not stated; and R. M. Buller, St. Michael's Rectory, Cornhill, E.C.3. Solicitors: Parker Garrett & Co., St. Michael's Rectory, Cornhill, E.C.

A. Webster & Sons (Burnley), Ltd.—Private company. Registered October 7th. Capital, £500 in £1 shares. Objects: To acquire the business of an electrical and wireless contractor now carried on by A. Webster at 26, Lyndhurst Road, Burnley. The subscribers are: A. Webster, 26, Lyndhurst Road, Burnley, and five others. A. Webster is one of the first directors. Registered office: 26, Lyndhurst Road, Burnley.

Crystal Twinlight (Western), Ltd.—Private company. Registered October 8th. Capital, £100 in £1 shares. Objects: To carry on the business of buyers, sellers and distributors of the electric lamps known as "Doto Crystal" lamps and any other electrical equipment manufactured by the Crystal Twinlight Co., and to acquire from D. T. Williams (Cardiff), Ltd., and A. W. Travis & Co., their stocks of these lamps, &c. The permanent directors are: D. T. Williams, 30, Tydraw Road, Cardiff; E. A. Travis, Westhaye, Southerndown, Glam; and W. M. Orders, Holme Croft, Woodville Road, Newport, Mon. Registered office: 126 and 127, Exchange Buildings, Mount Stuart Square, Cardiff.

Anglo Netherlands Radio Co., Ltd.—Public company. Registered October 9th. Nominal capital, £1,000 in £1 shares (500 5 per cent. cumulative preference). Objects: To establish, purchase, promote and develop any new or existing business of radio producers, distributors, diffusers and/or manufacturers in any part of the world; to acquire any land or buildings, to carry on business as financiers, &c. The first directors are: J. L. Leistra, 101, Schiekade, Rotterdam; and J. Bregmann, 72, Loodsgracht, Den Helder. The directors' borrowing powers are restricted to £200,000. Registered office: 110, Cannon Street, E.C.2.

Ardor Engineering Co., Ltd.—Private company. Registered October 5th. Capital, £100 in £1 shares. Objects: To carry on the business of insulating contractors and engineers, &c. The first directors are: R. F. Cox, 14, The Drive, Tonbridge; and E. P. Chaudoir, 14, Bloomfield Road, N.6. Registered office: 43/46, Southampton Buildings, W.C.2.

Radio Instalments, Ltd.—Private company. Registered October 8th. Capital, £100 in £1 shares. Objects: To carry on the business of banking in all its branches, and to grant special facilities and to enter into agreements with municipalities and supply companies, electrical, radio or television contractors and manufacturers, covering the sale, hire, hire-purchase or any other method of disposing of radio, electrical or television equipment. The subscribers are: R. F. A. Fytler, 61, Dalmally Road, Addiscombe, Croydon; and E. F. Jonas, 57, Penrith Road, Thornton Heath, Croydon. Registered office: 105/109, Judd Street, King's Cross W.C.

Terrell Industrial Corporation, Ltd.—Private company. Registered September 21st. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical and wireless apparatus and equipment, &c. The first directors are: R. Terrell, 24, Queen's Avenue, Muswell Hill, N.10; A. E. Jeffs, 79, Altmore Avenue, East Ham, E.; and C. Terrell, 24, Queen's Avenue, Muswell Hill, N.10.

Reicol, Ltd.—Private company. Registered October 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus, accessories and components, and in particular radio sets and valves, gramophones, radio gramophones, &c. The first directors are: F. W. Smith, "Highlands," Deep Cut, Surrey, and H. J. Taylor, "Aiee," Tudor Avenue, Worcester Park. Registered office: 9, High Street, Walton-on-Thames.

Barr Electric Co., Ltd.—Private company. Registered September 30th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers, dealers in and makers of electrical fittings, &c. The first directors are: A. J. Morris, 34, Church Road, Acton, London, W.3, and R. A. Barr, 6, Plympton Road, London, N.W.6. Solicitors: R. Hamilton Twyford & Co., 4, Regent Street, London, S.W.1.

Superior Electrode Manufacturing Co., Ltd.—Private company. Registered September 30th. Nominal capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrodes and leading-in wires of all descriptions, electric lamps, and electrical and wireless apparatus, &c. The subscribers are: J. Ismay, Roden Street Works, Ilford, Essex, and Thos. S. Cornwell, 9, Wilson Road, Southend-on-Sea. J. Ismay signs as director.

Returns of Electrical Companies

"New Era" Time & Telephone Systems, Ltd.—Satisfaction on September 23rd, 1935, to the extent of (a) £500 of mortgage registered October 20th, 1932; (b) of £500 of mortgage registered October 20th, 1932; (c) of £1,000 of mortgage registered November 26th, 1932; (d) of £62 10s. of mortgage registered November 26th, 1932; (e) of £128 18s. of mortgage registered July 11th, 1933; (f) of £136 19s. 3d. of mortgage registered July 11th, 1933.

Durham County Relay Service, Ltd.—Satisfaction in full on September 13th, 1935, of debenture dated November 14th, 1934, and registered November 21st, 1934, securing £200.

R. Roberts (Birmingham), Ltd.—Satisfaction to the extent of £300 on September 2nd, 1935, of debenture dated September 4th, 1931, and registered September 8th, 1931.

Globe & Simpson, Ltd.—The nominal capital has been increased by the addition of £18,000 in £1 ordinary shares beyond the registered capital of £12,000.

Helsby Cables, Ltd.—Capital, £2 in £1 shares. Return dated April 25th, 1935. Two shares taken up. £2 paid. Mortgages and charges, nil.

W. Willis & Co., Ltd.—Particulars filed of £2,500 debentures, authorised September 23rd, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

B. C. Garman, Ltd.—Particulars filed of £500 debentures, authorised July 24th, 1935, charged on the company's property, present and future, including uncalled capital, the whole amount being issued on September 16th, 1935.

Weston Wireless, Ltd.—Particulars filed of £2,000 debentures, authorised August 9th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Pirelli, Ltd.—Capital, £400,000 in £1 shares. Return dated April 3rd, 1935. All shares taken up £400,000 paid. Mortgages and charges, nil.

Northern Radio Construction Co., Ltd.—Capital, £100 in 10s. shares. Return dated April 3rd, 1935. 16 shares taken up. £8 paid. Mortgages and charges, nil.

Westminster Wholesale Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated April 23rd, 1935. 902 shares taken up. £902 considered as paid. Mortgages and charges, nil.

Kent Bros. Electric Wire Co. and E. H. Phillips, Ltd.—Capital, £40,000 in 11,500 "A" ordinary, 3,500 "B" ordinary and 25,000 preference shares of £1. Return dated April 18th, 1935. 11,500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares taken up. £27,800 paid on 2,800 "A" ordinary 2,300 "B" ordinary and 25,000 preference. £11,000 considered as paid on 11,000 "A" ordinary shares. Mortgages and charges, £1,916.

J. B. Electrical Co., Ltd.—Capital, £100 in 1s. shares. Return dated April 26th, 1935. All shares taken up. £100 paid. Mortgages and charges, nil.

Cornwall Power Co., Ltd.—Capital, £400,000 in £1 shares (250,000 ordinary and 150,000 preference). Return dated April 24th, 1935. All shares taken up. £190,000 paid on 40,007 ordinary and 150,000 preference. £209,993 considered as paid on 209,993 ordinary. Mortgages and charges, nil.

Western Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return dated April 8th, 1935. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Sheerness and District Electric Supply Co., Ltd.—Capital, £75,000 in £1 shares. Return dated May 14th (filed June 28th), 1935. All shares taken up. £75,000 paid. Mortgages and charges, nil.

Ericsson Telephones, Ltd.—The nominal capital has been increased by the addition of £200,000 beyond the registered capital of £500,000. The additional capital is divided into 800,000 ordinary shares of 5s. each. 300,030 ordinary shares of £1 each and 300.030 ordinary shares of 5s. each have been converted into £375,037 10s. ordinary stock.

Visco Engineering Co., Ltd.—Satisfaction in full on September 27th, 1935, of charge dated June 10th, 1932, and registered June 15th, 1932. (According to the register of mortgages, the charge registered June 15th, 1932, originally secured £9,000.)

West Insulating Co., Ltd.—Capital, £1,500 in £100 shares. Return dated May 10th, 1935. Ten shares taken up. £1,000 paid. Mortgages and charges, nil.

A. P. Lundberg & Sons, Ltd.—Capital, £30,000 in £1 shares. Return dated May 1st, 1935. All shares taken up. £30,000 paid. Mortgages and charges: £10,000.

William Geipel, Ltd.—Capital, £25,150 in £1 shares (25,000 preference, 100 "A" ordinary and 50 "B" ordinary). Return dated May 9th, 1935. All shares taken up. £23,650 paid, £1,500 considered as paid. Mortgages and charges, nil.

China & Japan Telephone & Electric Co., Ltd.—Capital, £200,000 in £1 shares. Return dated May 14th, 1935. 150,000 shares taken up. £60,239 paid, £89,761 considered as paid. Mortgages and charges, nil.

Furness Electrical, Ltd.—Debenture, dated September 16th, 1935, to secure £100, charged on the company's property, present and future, including uncalled capital. Holder: J. E. Coward, 119, Elverston Road, Dalton in Furness.

Safac Accumulator Co., Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1934 (filed April 2nd, 1935). 100 shares taken up. £100 paid. Mortgages and charges, nil.

Madras Electric Tramways (1904), Ltd.—Capital, £300.000 in 150.000 preference and 150.000 ordinary shares of £1. Return dated May 22nd, 1935. 125,000 preference and 100,000 ordinary shares taken up. £112,740 paid (being £1 per share on 92.500 preference and 17.740 ordinary and 2s. per share on 25.000 ordinary). £89,760 considered as paid on 32,500 preference and 57,260 ordinary shares. Mortgages and charges: £118,400.

V.G. Manufacturing Co., Ltd.—The nominal capital has been increased by the addition of £15,000 in £1 ordinary shares beyond the registered capital of £3,000.

Aldwych Lamp Co., Ltd.—The nominal capital has been increased by the addition of £19,000 beyond the registered capital of £6,000. The additional capital is divided into 76,000 shares of 5s. each.

Fe-Ni-Ca Accumulators, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1934 (filed May 20th, 1935). All shares taken up. £2,500 paid. £7,500 considered as paid. Mortgages and charges, nil.

North Electrical Co. (1929), Ltd.—Capital, £1,000 in £1 shares. Return dated September 12th, 1934 (filed May 16th, 1935). All shares taken up. £301 paid, £699 considered as paid. Mortgages and charges, nil.

City Notes

The Electrolytic Zinc Co. of Australasia, Ltd., reports a net profit of £256,020 for the year ended June 30th last, after providing £145,000 for amortisation and depreciation and £55,923 for taxation, as compared with £234,797 in the preceding year. A dividend of 5 per cent. for the year was announced in July (against 4 per cent.).

Callender's Cable & Construction Co., Ltd., has declared an interim dividend of 5 per cent., less tax (unchanged).

The River Plate Electricity Co., Ltd., has again announced an interim ordinary dividend of 3 per cent., less tax.

The Calcutta Electric Supply Corporation, Ltd., has declared an interim ordinary dividend of 5 per cent., free of tax (same).

The Telephone & General Trust, Ltd., is paying an interim dividend of 3 per cent. on the ordinary shares (same).

The Ever Ready Trust, Ltd., has announced an interim dividend of 3 per cent. on both the ordinary stock and deferred shares (unchanged).

Babcock & Wilcox, Ltd., are maintaining their interim ordinary dividend at 4 per cent.

The Ebonite Container Co., Ltd., has declared an interim dividend of 4 per cent. (same).

Erinoid, Ltd., proposes to pay a dividend of 10 per cent. on the ordinary shares for the year ended July 31st last (against 11½ per cent. for 1933-34).

The Telephone Manufacturing Co., Ltd., is paying an interim dividend of 2½ per cent., less tax. In the preceding year no interim dividend was paid, the final distribution being 2½ per cent.

Telephone Properties, Ltd., has declared an interim dividend on the ordinary shares of 2 per cent., less tax (same).

The Anglo-Portuguese Telephone Co., Ltd., proposes to pay an interim ordinary dividend of 3 per cent., less tax (unchanged).

The Oriental Telephone & Electric Co., Ltd., is maintaining its interim ordinary dividend at 4 per cent., tax free.

Stocks and Shares

TUESDAY EVENING.

IT is hardly too much to say that prices in the Stock Exchange markets are changing almost hour by hour, according to the fluctuating character of news received from Geneva, Rome and the war area. People are becoming accustomed to a statement made in the morning being contradicted in the afternoon. Yet at the same time even irresponsible rumours play their part in causing price-fluctuations. The financial position of Italy, anything but bright before ever the war was thought of, is now worse than ever, so far, that is to say, as external creditors of the country are concerned. The old saw, however, that want of money never stopped a country from prosecuting a war, is once more exemplified. The gilt-edged markets are tolerably steady. There is a fair amount of money coming into British "safety-first" stock. The idea of possible new issues of a large extent being made before this year runs out, has no particular effect upon the steady absorption of stock that goes on regularly every business day. The iron and steel market continues to be the most popular amongst the industrial sections, while sharp rises in the prices of cable and wireless stocks followed upon substantial buying of all three issues.

Cable and Wireless

There was something breathless in the manner with which Cable and Wireless preference and ordinary stocks advanced, towards the end of last week, under the pressure of the demand just noted. Reasons had to be found, of course, for the sudden accession of buying. Some people reported that Cable and Wireless was the only communication system through which news could be transmitted to and from Abyssinia. To what extent this was correct, nobody seemed to know, but it helped to strengthen the market in the stocks. A more complicated explanation said that it had recently become known that Cable and Wireless had made a big profit—approximately a million pounds, according to report—through the sale of certain of its investments to the Cables Investment Trust, and that the directors of Cable and Wireless had under consideration a proposal for paying off the arrears of dividend on the Cable preference. These amount to 9½ per cent.; and, if rumour is correct in this respect, the A ordinary stock will come, of course, within sight of a distribution. Whatever may have been the cause, the fact remained that in a somewhat narrow market the stocks were advanced with a rush. The preference rose 2 to 100½, but

relinquished the fraction. The A touched 26 before going back to 25, gaining 2 points on the week. The B ordinary at 7¾ is up 1¼. In the market, the reaction was ascribed to profit-taking. Jobbers seem to think that the advance will be resumed when the market becomes more tranquil.

American "Tel. and Tel." Better

Globe Telegraph and Trust ordinary are 15s. up at 13½ in sympathy, of course, with the Cable and Wireless issues. Cables Investment preference are better at 10½, the debenture stock at 99¼ also having improved. Amongst the Anglo-American stocks, American Telephone and Telegraph at 143½ show recovery of their last week's fall of 5 points. Internationals are 9½.

Electricity Supply Shares

The market in the ordinary shares of the Home electricity supply companies shows comparatively few fluctuations, and those which have occurred are of no great importance. Clyde Valley and Scottish Power are both standing at the same price, namely 40s. As the dividends in each case are 8 per cent. it would appear appropriate that the prices should have met together in this way, affording at the present time a yield, of course, of 4 per cent. on the money. Lancashire Light and Power are a little better at 36s. 6d., and microscopic rises have occurred in the ordinary shares of North Eastern Electric, Northamptonshire and Electrical Distribution of Yorkshire. Yet it may be said, however, that these improvements scarcely exceed 3d. in each case; and, for this reason, the official quotations are left unchanged. In the London list, County ordinary recovered to 54s. Edmundson's are 6d. better at 40s. 6d. Of the overseas shares, Palestine A at 47s. 6d. are slightly firmer. Calcutta Electric ordinary at 62s. are ex the rights to apply for the new shares at 45s. Acceptance in respect of the last-named had to go in by Tuesday in this week. Proprietors who live outside Europe are given an extension of time for sending in their forms.

Shares on Offer

A line of the new ordinary shares recently offered by the Scottish Power Company, have come on offer at 38s. 9d. They can be bought, at present, free of stamp duty, and there are 10,000 available. Half this number of 6 per cent. preference shares in the North Metropolitan Electric Power Supply Company are in the market at 31s. 7½d., which carries a half-year's dividend due on November 1st. The yield is £3 17s. In the last-published accounts the dividend service was covered eight times over. It is superfluous to add that the shares may have been taken before the day on which this journal appears. As regards high-priced preference shares, however, the investment demand continues to show signs of falling off: demand is concerned increasingly with the ordinary shares of good industrial companies.

Manufacturing and Equipment

Popular inquiry at the present time is running, also, upon stocks and shares in companies that may be expected to benefit in any way by the war. Indirectly, the effect of the Italian-Abyssinian affair is to focus interest upon the necessity for rearmament in this country. Accordingly, iron and steel shares are being bought, with the result that industrials in specialised departments are enjoying a good deal of activity in the Stock Exchange markets. The animation tends to spread to the shares of any companies which can claim even a nodding expectation of increased business due to the iron and steel revival. Babcock & Wilcox might have been in the forefront of the movement, but the declaration of an interim dividend of 4 per cent., repeating that of a year ago, came as a cold douche to those who had been looking for an increase. The announcement brought in sellers, and the price, 50s., shows a loss of 1s. 3d. on the week. Vickers, after being up to 20s., reacted to 19s. Ericsson Telephone ordinary shares in their new shape as 5s. units, have been an active market on the basis of 30s. They are being accumulated by people who think that there is a chance of the dividend being increased, and who consider that at 30s. the shares are likely to appeal to the investor on the look-out for possible appreciation in price and income. Telegraph Condenser ordinary shares have been a strong market at 55s., from which the price reacted to 54s., leaving it better on the week. International Automatic Telephone deferred shares at 38s. have gained a few pence. Telephone Manufacturing strengthened to 8s. upon declaration of an interim dividend of 2½ per cent., against nil a year ago. Chloride Electrical Storage "B" shares, with a rise to 77s. 6d., have drawn level with the company's "A" shares.

Miscellaneous Matters

The result of the Canadian General Election, giving the Liberal Party an overwhelming victory over the Conservatives, induced a harder tone amongst utilities. Canadian Marconis improved to 7s. 6d. Several of the hydro-electric prices advanced. The announcement that there will be an early General Election in our own country has been accepted as a bull point for Stock Exchange markets, in that the return of the present Government is considered to be a practical certainty. Rubber shares are picking up, thanks to a mild rally in the price of the produce. The interest lately shown in television shares has temporarily declined.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Oct. 15.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3¾	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 0
Clyde Valley	1	7	8	40/–	–1/–	4 0 0
County of London	1	10½	10½	54/–	–1/–	3 17 9
Edmundson's 7% Pref.	1	7	7	35/–	—	4 0 0
Do. Ord.	1	7	8	40/–	—	4 0 0
Elec. Dis. Yorkshire	1	9	9	46/–	—	3 17 9
Elec. Fin. and Securities	1	12½	12½	3¾	—	3 14 2
Elec. Supply Corporation ...	1	11	11	3⅛	—	3 11 10
Lancs Light and Power	1	7½	7½	36/6	+6d.	4 2 2
Lond. Assoc. Electric	1	—	—	34/–	+1/–	4 2 4
London Electric	1	7	8	38/6	—	4 3 9
London Power deb. Red.... ...	Stock	5	5	108½	—	4 12 4
Metropolitan	1	10	10	50/–	—	4 0 0
Midland Counties	1	7	7	35/6	—	3 19 0
Mid. Elec. Power	1	8	8	41/3	+6d.	3 17 6
North Eastern Electric Ordinary	1	6	6	32/0	—	3 15 0
Do. 7% Pref.	1	7	7	34/–	—	4 2 2
Northampton	1	10	10	50/–	—	4 0 0
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary ...	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	31/6	—	3 16 2
Scottish Power	1	8	8	40/–	+1/–	4 0 0
South London	1	7	7	33/6	—	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/6	—	6 13 4
Yorkshire Elec.	1	8	8	42 6	—	3 15 5
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	114	—	4 7 9
Do. 1955–75 ...	,,	5	5	117	—	4 5 6
Do. 1951–73 ...	,,	4½	4½	110	—	4 1 10
Do. 1963–93 ...	,,	—	3½	102	—	3 8 6
London Elec. Trans. Gtd. ...	,,	—	2½	94	—	2 13 2
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 0
London Passenger Transport, A...	,,	—	4½	120½	—	3 14 8
Do. do. B...	,,	—	5	125½	—	3 19 3
Do. do. C...	,,	3½	4	99	+1	4 0 10
West Midlands Joint Elec. 1948–68	,,	—	5	115	—	4 7 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	143½	+5	6 5 5
Anglo-Am. Tel. Pref.	Stock	6	6	116	—	5 3 0
Do. Def. ...	,,	1½	1½	27½	—	5 9 1
Cable & Wireless 5½% Pref. ...	,,	2¾	4½	100	+1½	4 2 6
Do. A. 7½% Ord.	,,	Nil	Nil	25	+2	—
Do. B. Ord.	,,	Nil	Nil	7¾	+1½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	13½	+½	2 11 10
Do. do. Pref.	10	6	6	13½	—	4 9 0
Great Northern Tel.	10	20	20	38½	–½	5 4 0
Marconi-Marine	1	10	7½	30/9	—	4 17 5
Oriental Telephone Ord.	1	12	12	3	–⅛	*4 0 0
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1050	—	—
Do. do. Pref. Ord.	,,	8	8	165	–5	4 17 0
Brazil Traction	100	—	—	7½	—	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	97½	–1	5 2 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	20	3⅛	—	—
West Riding	1	5	6½	40/9	—	3 4 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	60/–	+6/3	5 0 0
Assoc. Elec. Ord.	1	4	6	34/–	—	3 10 7
Do. Pref.	1	8	8	37/–	—	4 6 4
Babcock & Wilcox	1	6	8	50/–	–⅛	3 2 4
British Aluminium Ord.	1	5	7½	42/6	+1/–	3 10 7
British Insulated Ord.	1	5	15	4¼	—	3 8 8
Brush Ord.	Stock	Nil	Nil	42½	—	—
Callender's	1	15	15	3⅜	—	4 1 4
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord. ...	5/–	—	12½	3⅛	–⅛	0 18 6
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	24/3	—	2 17 9
Enfield Cable Ord.	1	25	25	4¾	—	5 2 6
English Electric	1	Nil	Nil	16/3	—	—
Do. do. Pref.	1	Nil	Nil	22/–	—	—
Ericssons Tel.	5/–	—	24	31/3	+⅛	—
Ever Ready	5/–	35	35	22/–	—	7 19 1
Ferranti Pref.	1	7	7	27.6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	10	3½	—	3 4 0
Henley's	1	30	30	6⅜	+⅛	4 8 0
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1¼	—	4 17 9
Johnson & Phillips	1	5	7½	41/3	—	3 12 9
Siemens Ord.	1	6½	4	22/6	—	3 11 1
Telegraph Construction	£1	Nil	Nil	23/9	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

34965. "Protective arrangements for electric power plant." General Electric Co., Ltd., G. Ellis, and C. W. Saunders. December 12th, 1933. (435181.)

35432. "Apparatus for raising and removing gas, electric, and other lamps to and from their positions over a street, open space, or similar inaccessible position." W. Slingsby & Co., Ltd., W., T. J. L., and W. N. Slingsby. December 16th, 1933. (Cognate application 2539/34.) (435381.)

35511. "Braun tube, and method of producing Braun tubes." Radioakt.-Ges., D. S. Loewe, and K. Schlesinger. December 17h, 1932. (Cognate application 35512/33.) (435382.)

35549. "Electron-discharge device." Hazeltine Corporation. January 30th, 1933. (435383.)

35635. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., B. H. Leeson, and R. W. Wild. December 18th, 1933. (Cognate application 1426/35.) (435250.)

36065. "Potential-steadying device making use of glow lamps." Radioakt.-Ges. D. S. Loewe and K. Schlesinger. December 24th, 1932. (435447.)

1934

4628. "Timers for high-frequency currents." Oliver Pell Control, Ltd., C. Oliver and G. H. Moody. February 12th, 1934. (435255.)

5358. "Photo-electric cell amplifier." Radioakt.-Ges. D. S. Loewe. February 20th, 1933. (435387.)

5493. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and R. Maxted. February 19th, 1934. (435310.)

5662. "Electrolysis of water." A. E. Knowles. February 21st, 1934. (435450.)

7835. "Construction and operation of cathode-ray tubes." K. F. Hardie and L. H. Soundy. March 12th, 1934. (Cognate application 10240/34.) (435191.)

7946. "Electric welding apparatus." British Thomson-Houston Co., Ltd., and A. L. Whiteley. March 13th, 1934. (435193.)

8070. "Electric-discharge devices." General Electric Co., Ltd., J. T. Randall, N. L. Harris, and J. W. Ryde. March 14th, 1934. (435266.)

8095. "Electric cables." Pirelli-General Cable Works, Ltd., and R. E. Horley. March 14th, 1934. (435454.)

8200. "Thermostatic switches." British Thomson-Houston Co., Ltd., C. J. Morton and W. J. Sims. March 15th, 1934. (435269.)

8219. "Telephone systems." Automatic Electric Co., Ltd., R. Taylor and G. T. Baker. March 15th, 1934. (435313.)

8221. "Electrical liquid-level indicators." R. A. Hall. March 15th, 1934. (435455.)

8346. "Electrical power measuring means for prime movers." General Electric Co., Ltd., and E. C. Davies. March 16th, 1934. (Cognate application 15668/34.) (435397.)

8350. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., E. P. G. Wright and G. C. Hartley. March 16th, 1934. (435398.).

8576. "Electric oscillators and the like." D. M. Johnston and Baird Television, Ltd. March 19th, 1934. (435196.)

8626. "Control of electric motors in traction systems." H. K. Ramsden and Associated Electrical Industries, Ltd. March 19th, 1934. (435405.)

8732. "Automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. March 23rd, 1933. (435409.)

8739. "Telephone systems." Automatic Electric Co., Ltd., and H. S. Woodhead. March 20th, 1934. (435411.)

8796. "Secret combination electric switches for ignition and other circuits." T. E. Brooker. March 21st, 1934. (435197.)

8891. "Electric rectifiers." British Thomson-Houston Co., Ltd. March 22nd, 1933. (435198.)

9004. "Fire-alarm systems." Telefonaktiebolaget L. M. Ericsson. March 24th, 1933. (435463.)

9027. "Electric remote-control of apparatus over power mains." Automatic Electric Co., Ltd., and P. N. Roseby. March 22nd, 1934. (435464.)

9166. "Modulating and demodulating apparatus for a.c. signalling systems." General Electric Co., Ltd., and E. P. L. Westell. March 23rd, 1934. (435201.)

9181. "Electric percussive tools." L. Schor. March 23rd, 1934. (Cognate application 30023/34.) (435416.)

9198. "Scanning-devices for use in television and the like systems." Marconi's Wireless Telegraph Co., Ltd., and N. Levin. March 23rd, 1934. (435478.)

9235. "Apparatus for the production of relaxation oscillations." Allgemeine Elektricitats-Ges. March 23rd, 1933. (435486.)

9248. "Braun tube for television purposes." Radioakt.-Ges. D. S. Loewe. March 29th, 1933. (435203.)

9249. "Detector arrangement for wireless receivers, more particularly for television purposes." Radioakt.-Ges. D. S. Loewe. March 29th, 1933. (435417.)

10570. "Manufacture of dielectric materials." Telegraph Condenser Co., Ltd, and F. C. Stephan. April 7th, 1934. (435323.)

11223. "Electric circuit-breakers." C. H. Flurscheim and Associated Electrical Industries, Ltd. April 13th, 1934. (435419.)

12591. "Machines for the manufacture of stranded electric conductors." Norddeutsche Seekabelwerke Akt.-Ges. June 21st, 1933. (435421.)

13466. "Electric plug-in couplings." R. T. Waite. May 4th, 1934. (435330.)

13553. "Coin-feed prepayment mechanisms for meters." British Electric Meters, Ltd., and R. W. Jolly. May 4th, 1934. (435332.)

16528. "Intermediate electric tumbler switches." C. H. Parsons, Ltd., and G. B. Handley. June 4th, 1934. (435284.)

16858. "Photo-electric photometers." H. F. Tönnies. June 6th, 1933. (435335.)

17173. "Brake mechanism for electric trolley-buses and other vehicles." Ransomes, Sims & Jefferies, Ltd., and W. Gilbert. June 9th, 1934. (435498.)

17518. "Electrically operated devices for controlling or regulating the level of liquid or other flowing materials." Evershed & Vignoles, Ltd., and J. C. Needham. June 13th, 1934. (Cognate application 11783/35.) (435426.)

17859. "Electric current transformers for use more particularly with automatic electric welding machines." A. J. Thorneloe. June 16th, 1934. (435285.)

23316. "Thermally operated electric relays." Bresson et Cie. and S. J. B. Thomas. June 11th, 1934. (Addition to 412799.) (435289.)

24133. "Electric-discharge tube oscillation generators.' M-O Valve Co., Ltd., and E. C. S. Megaw. August 21st, 1934. (435291.)

27991. "Indicating-means for radio receiving apparatus." A. G. Pearson. November 5th, 1934. (435432.)

34159. "Maximum cut-out for direct or alternating current." Coucima Soc. Anon. November 28th, 1933. (435435.)

35123. "Electric accumulators." F. Maerteus. December 6th, 1933. (435436.)

35844. "Electro-magnetic track brakes." Knoor-Bremse Akt.-Ges. July 31st, 1934. (435508.)

35845. "Electro-magnetic track brake." Knoor-Bremse Akt.-Ges. September 27th, 1934. (435509.)

35849. "Lids for electric batteries." Ever Ready Co. (Great Britain), Ltd., and E. N. Rowbotham. December 13th, 1934. (435235.)

37037. "Variable induction compass with potentiometric control and indicator." U. Guerra. December 28th, 1933. (435437.)

1935

516. "Mechanical recording of oscillations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 9th, 1934. (435515.)

3105. "Electric socket-connector devices." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1934. (435439.)

4963. "Electrolytic condensers." Siemens & Halske Akt.-Ges. February 1st, 1934. (435300.)

6950. "Modulated carrier-wave apparatus." Telefunken Ges. für Drahtlose Telegraphie. March 5th, 1934. (435302.)

11784. "Electrically operated devices for indicating and measuring the level of liquids." Evershed & Vignoles, Ltd., and J. C. Needham. June 13th, 1934. (Divided out of 435426.) (435441.)

15788. "Starting arrangements for electric-discharge devices." British Thomson-Houston Co., Ltd. May 31st, 1934. (435442.)

16269. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., B. H. Leeson, and R. W. Wild. December 18th, 1933. (Divided out of 435250.) (Cognate application 16270/35.) (435308.)

22565. "Telephone systems." Automatic Electric Co., Ltd., R. Taylor and G. T. Baker. March 15th, 1934. (Divided out of 435313.) (435379.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 9th:—

Vitex. No. 561570. Class 6. Portable power-driven machine tools.—Oliver Pell Control, Ltd., Cambridge Place, Burrage Road, Woolwich, S.E.18.

Printograph. No. 558069. Class 8. Measuring and recording electrical instruments.—Landis & Gyr, Ltd., Elgee Works, Victoria Road, North Acton, W.

Rayspa. No. 560921. Class 11. Infra-red ray apparatus for surgical and curative purposes.—Hala (England), Ltd., Albion House, 59, New Oxford Street, W.C.1.

Floorcrete. No. 562487. Class 13. Electric lighting, heating and power fittings, all made of ordinary metal.—Floorcrete Conduit Fittings Manufacturing Co., Ltd., 85a, Western Road, Ealing, W.5.

Corundite. No. 562513. Class 18. Electrical insulators made of porcelain or earthenware.—K.L.G. Sparking Plugs, Ltd., Robin Hood Engineering Works, Putney Vale, S.W.15.

A Large Bright-annealing Furnace

In our issue of May 17th, when reporting a visit to the works of Messrs. Henry Wiggin & Co., Ltd., Birmingham, in connection with the centenary of that firm, we referred to the notable electric-furnace equipment installed, in particular those for continuous bright annealing. Open annealing is unsuitable for nickel and monel metal as the oxide scale formed is hard to remove and the metal surface is liable to be spoilt by the strong pickling solutions required. Close annealing in packs took more than a day and prevented accurate control of grain size.

According to the *Nickel Bulletin*, the furnace designed by Birmingham Electric Furnaces, Ltd., for taking sheets up to 4 ft. 6 in. in width is constructed on similar lines to that now used for strip and narrow sheets, but is probably the largest of its type in the world, the length of the heating chamber being 12 ft., of the cooling chamber 36 ft., and overall 84 ft. Elements of a 250-kW resistor are arranged in three zones in the heating chamber, each with its temperature automatically controlled within a normal range of from 750 to 900 deg. C. A wire-mesh belt conveyor of nickel-chromium is motor-driven through reduction gearing with a variable-speed device to vary the cooling times to suit different materials. Sheets in a maximum of three layers are conveyed through an atmosphere that has been freed from air, oxygen, sulphur and water vapour, the total operation taking about one hour. As the metal is at annealing temperature for a few minutes only, excessive grain growth is prevented. Many other "Birlec" furnaces are in use in this plant, all heat treatment now being carried out electrically.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alford (LINCOLNSHIRE).—Houses (51); U.D.C. surveyor.

Barnstaple.—Houses (20), Derby Road; borough surveyor.

Becontree (ESSEX).—Factory, Oxlow Lane; Windsor Hosiery Co., Ltd., Windsor House, Ropemaker Street, London, E.C.2.

Birmingham.—R.C. schools, adjoining Rosary Church, Saltley (£30,000) with electrical work; J. A. Crush, architect, 37, York Road.

Blackpool.—Laundry, Bispham, for the North East Lancashire Co-operative Laundries Association, Oswaldtwistle; William Livesey & Sons, Ltd., builders, Nova Scotia Works, Blackburn.

Blyth.—Houses (184), Kitty Brewster and Hodgson's Road; direct labour under supervision of borough engineer (L. Leeper).

Bolton.—Cinema (2,500 seats), Ashburner and Blackhorse Streets; Odeon Theatres, Ltd.

Bradford.—Houses, Canterbury Road estate; city architect. Houses (31), Cemetery Lane, Lidget Green; F. & H. Brown.

Brandon (Co. DURHAM).—Houses (55); U.D.C. surveyor.

Bury (LANCASHIRE).—Schools, East Ward (£9,000); director of education.

Bury St. Edmund's.—Cinema, Brentgovel Street, for the Gaumont British Picture Corporation, Ltd.

Cambridge.—Cinema, St. Andrew Street (£40,000); Associated British Cinemas, Ltd.

Cardiff.—Houses (2,000); city engineer. Houses (32), Sloper Road; C. Brown & Co. Sports arena and hall, Wood Street (£210,000); Corporation and Syndicate.

Chard.—Butter factory, for the United Dairies Co.

Cheshunt.—Houses (34), Cambridge Arterial Road, for E. J. Ripley.

Chesterfield.—Cinema, Cavendish Street; L. Morris.

Cranleigh (SURREY).—Cinema, High Street; Pryke & Son.

Crewe.—Houses (278), by direct labour; borough surveyor.

Crook (Co. DURHAM).—Houses, Foundry Fields; U.D.C. surveyor.

Croydon.—Houses (116), Crown Hill estate; F. T. Wooding & Son, 1, Rockhampton Road. Factory for Cotton & Co., Sydenham Road; A. F. W. Rees & Partners, 27, High Street.

Darlaston.—Houses (36); J. F. Hughes, Ltd., builders, Wolverhampton.

Deal.—Senior schools, electrical work, for Borough E.C.; H. M. Barker, architect, 16, King Street.

Denham (BUCKINGHAMSHIRE).—Houses (30), Oxford Road, for A. J. Perkins.

Derby.—Extensions to Technical college (£21,995); Gee, Walker & Slater, builders.

Derbyshire.—School, Tideswell, near Buxton, for County E.C.; Henfrey & Co., builders, Walkden Street, Mansfield.

Eastbourne.—Houses (22), Marlow Avenue; Prospect Houses, Ltd.

Eccles.—Houses (24), Catherine Street; Wilham Estates, Ltd.

Edgware (MIDDLESEX).—Houses (600), Fairview estate; Hilbery Chaplin, Ltd., Russell Parade, Golder's Green, N.W.11.

Featherstone.—Church; Fox & Hill, architects, Union Street, Dewsbury.

Finchley.—Houses (24), Gordon Road; Oakdene Estates, Ltd. Motor showrooms and offices, High Street; Gt. Northern Motors, Ltd.

Gosport.—School, Privett (640 places); director of education.

Guildford.—Houses (200), Wesborough; borough surveyor.

Harrow.—Houses (70), Berridge Housing estate, Stanmore; Council's surveyor.

Hebburn-on-Tyne.—Cinema, Victoria Road East, for E. J. Hinges, Ltd., cinema proprietors, 72, Grey Street, Newcastle-on-Tyne.

Hoddesdon.—Houses (58) and bungalows, Essex Road estate; Broadoak Building Co., Ltd., builders, Waltham Cross.

Houghton-le-Spring.—Houses (95); V. J. Hunter, U.D.C. surveyor.

Huddersfield.—Public library and art gallery, Ramsden Street; E. H. Ashburner, architect, Sheffield.

Hull.—Houses (176), Marfleet estate; city architect. Reconstruction of Grand Theatre for Associated Hull Cinemas, Ltd.; Blackmore & Sykes, architects.

Huntingdon.—Houses (20); borough surveyor.

Irish Free State.—(BALLINA, Co. MAYO).—Houses (174); P. A. Calleary, engineer, Pearse Street, Ballina. (MONAGHAN).—Clinic buildings and other works for the Board of Health and Public Assistance; B. Coyle, secretary.

Iver (BUCKINGHAMSHIRE).—Houses (32), Church Road, for Henry Boot, Ltd.

Kippax (YORKSHIRE).—Houses (30), Preston Lane, for Ramsden & Rhodes.

Kirkham.—Houses (20); J. R. Holmes, U.D.C. surveyor.

Lampeter.—Houses (two blocks), New Street site; Bankes, Price & Gwilym Davies, architects, Lampeter.

Lancashire.—Senior girls' school, Westhoughton; county architect.

Lanchester.—Houses (677); E. Simpkin, surveyor.

Lincoln.—Houses (160), and flats; city surveyor.

Liskeard.—Alterations and additions to Public Assistance Institution; county architect.

London.—(WESTMINSTER).—Buildings, Ormonde Square; Gordon Jeeves, architect, 16, Hanover Square, W.1. Buildings, 113-7, Wardour Street; S. W. Smedley, 24, Gt. Tower Street, E.C.3. Stadium, Grosvenor Road; Buckland & Haywood, architects, 5, Verulam Buildings, W.C.1.

Malling (KENT).—Houses (22), East Peckham; J. Hole, R.D.C. surveyor, High Street, West Malling.

Malvern.—Cinema, Worcester Road, for the D. & D. Cinemas, Ltd., Birmingham.

Margate.—Schools and extensions (£42,000); director of education.

Midhurst.—Houses (40); R.D.C. surveyor.

Newcastle-on-Tyne.—Houses (35), St. Julian's Gardens; Walter Willson, Ltd., builders, Grey Street.

Norfolk.—Central schools, Stalham; director of education, Norwich.

North Riding.—School, New Earswick, for County E.C.

Norton (YORKSHIRE).—Houses (34); R.D.C. surveyor.

Orsett (ESSEX).—Houses (80), East Tilbury, for the Bata Shoe Co., Ltd.

Oxford.—Houses (24), Iffley Turn estate; E. Organ & Sons. College, Cowley Road, for E.C.

Oxted (SURREY).—Houses (44), Broadham Green, for F. W. Holliday.

Peterborough.—Cinema, Broadway; Odeon Theatres, Ltd.

Plymouth.—Schools, five years' building programme (£215,500), for E.C.

Portsmouth.—School, Waterworks Road, Farlington, for E.C. Training college, Milton; director of education.

Ramsgate.—Hotel, cinema, and electrical railway, Hereson, for Ramsgate Olympia, Ltd.; D. F. Warren, managing director.

Retford.—Senior girls' school (480 places), Hallcroft site; Education Committee.

Rugby.—Houses (50) and bungalows; H. Adams & Sons, Ltd., builders.

St. Helens (LANCASHIRE).—Houses (360), Grange Park estate; borough surveyor.

Sheerness.—Cinema, for East Kent Cinemas, Ltd.; P. W. Thomas, joint managing director, Faversham.

Skegness.—Holiday camp, with 600 chalets, shops, &c., electrical work (£30,000), for W. E. Butlin.

Southall.—Houses (36), Lady Margaret Road; George Wimpey & Co., Ltd. Houses (150), Viaduct Fields estate; R. Fielding & Sons. Cinema, High Street; Odeon Theatres, Ltd.

Southgate.—Houses (84), Telford Road; J. M. Webster & Co.

South Shields.—Municipal assembly hall, adjoining Town Hall (£35,000); town clerk.

Spalding.—Houses (84) and flats (£23,495); G. W. Horten, builder, Horncastle.

Staffordshire.—Senior school (360 places), Kingswinford, for County E.C.; education architect, Stafford.

Staines (MIDDLESEX).—Omnibus garage and depôt, for the London Passenger Transport Board; Wilson Lovatt & Sons, Ltd., Abbey House, Victoria Street, London, S.W.1.

Stockport.—Secondary school for boys, Mile End (electrical work); A. Lawton, director of education, Town Hall.

Stockton-on-Tees.—School, Norton, for St. Joseph R.C. managers; priest-in-charge. Houses (97), Keithland Road; A. J. Blackett, builder, "Elmcourt," Greylands Avenue, Norton-on-Tees.

Sunderland.—Additions to premises, Hylton Road, for F. Fenwick and Sons; G. E. Matkin, architect, Barclays Bank Chambers, Fawcett Street.

Sutton Coldfield.—Houses (74), Bearwood Road; F. C. Price, Ltd. School, Holland House estate, for E.C.

Tendring (ESSEX).—Houses (20), Little Clacton; F. J. Mold, builder, Ipswich Road, Colchester.

Torquay.—Houses (95), Marldon Road; Premier Trust, Ltd. Houses (400), Watcombe; borough engineer.

Twickenham.—Houses (32), Crane Court estate; Couch & Coupland, architects. Houses (34) and shops, Hospital Bridge Road, for Wates (Malden), Ltd. Cinema, shops and flats, Nelson Road and Percy Road; W. J. King.

Tynemouth.—Houses (140), Percy Square (£100,000); A. K. Tasker, architect, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Wakefield.—Houses (24), Gill Syke estate, and shops, Lupset estate; city architect.

Wallsend-on-Tyne.—Houses (50), Station Road (£15,400); borough engineer.

Walsall.—Houses (66), Delves estate (£17,767); L. G. Peace. School, Harden, for E.C.

Walsingham.—Houses (29), Great Walsingham; T. J. Jupp, junior, builder, Wisbech.

Warrington.—Houses, Parr Street; Perdue & Whitfield. X-ray buildings, Borough Hospital; Osborne & Co., Ltd. Works, Broad Arpley Lane; Mayhall & Tomlinson.

Warwick.—Houses (24); E. Arthur Lyne, R.D.C. surveyor, Waterloo Place, Leamington Spa.

Wellingborough.—Cinema, café and shops, Midland Road; John Ray, Ltd., builders, Letchworth.

West Hartlepool.—Houses (157), Old Town, to rehouse slum clearance tenants; borough engineer.

Weymouth.—Schools (£250,000); director of education.

Whitburn.—Houses (200), Whitburn estate, with electrical work; D. D. Sandeman, town clerk, National Buildings, Bathgate.

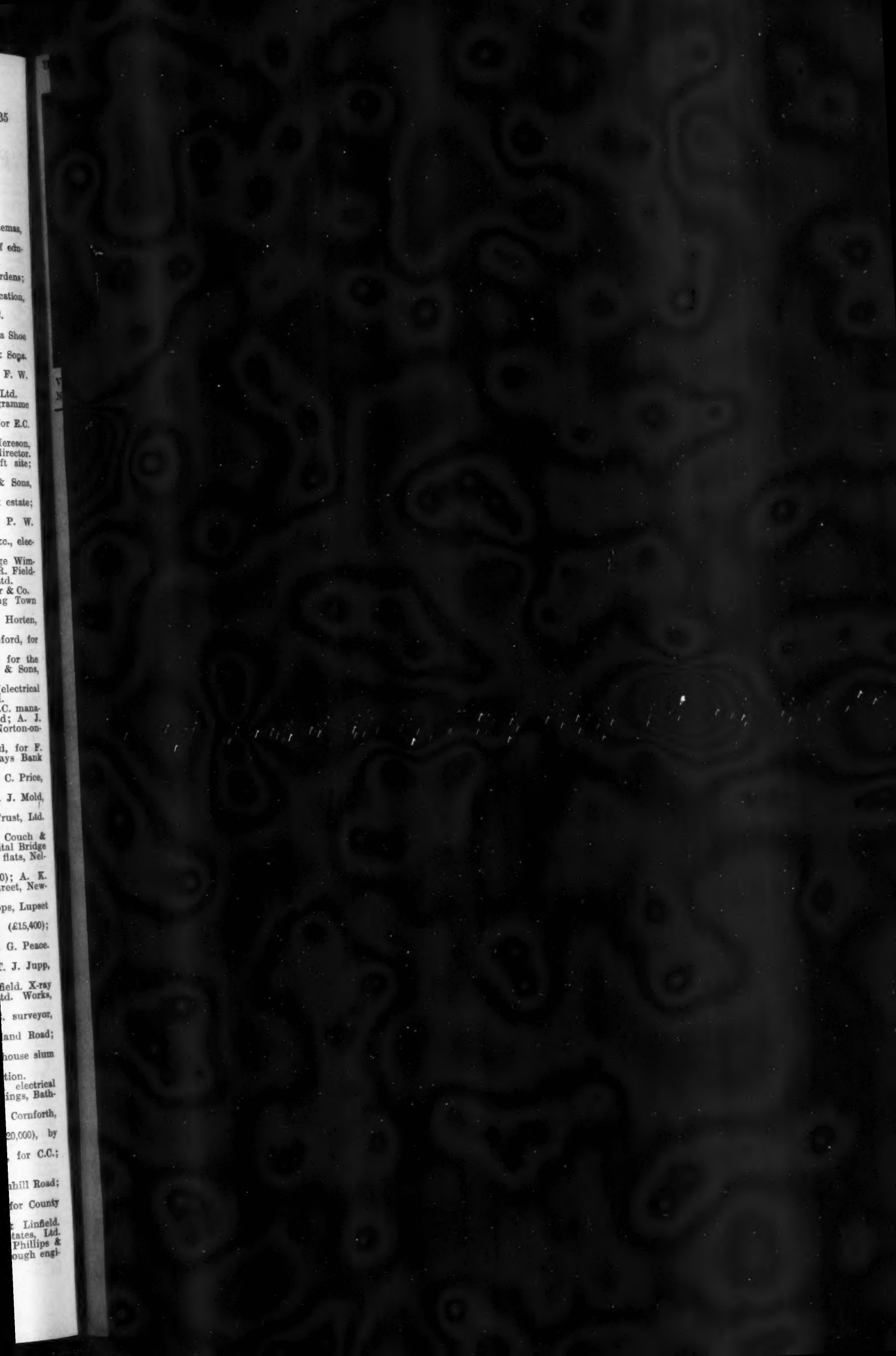
Whitby.—Houses (106), Gallows Close estate; W. Cornforth, builder.

Wigan.—Extensions to Municipal Buildings (£20,000), by direct labour; borough engineer.

Wiltshire.—County offices (£113,000), Trowbridge, for C.C.; P. Hepworth, architect, London.

Wokingham.—Houses (22); R.D.C. surveyor.

Woodford.—Extensions to Jubilee Hospital, Broomhill Road; Governors.

Worcestershire.—Central school, Tenbury Wells, for County E.C.

Worthing.—Houses (28), Ham Way; Payne & Linfield. Houses (20), Littlehampton Road; Chatsmore Estates, Ltd. Development of Newlands Park estate; Willmore, Phillips & Co. Extensions to Swandean Hospital (£24,700); borough engineer.